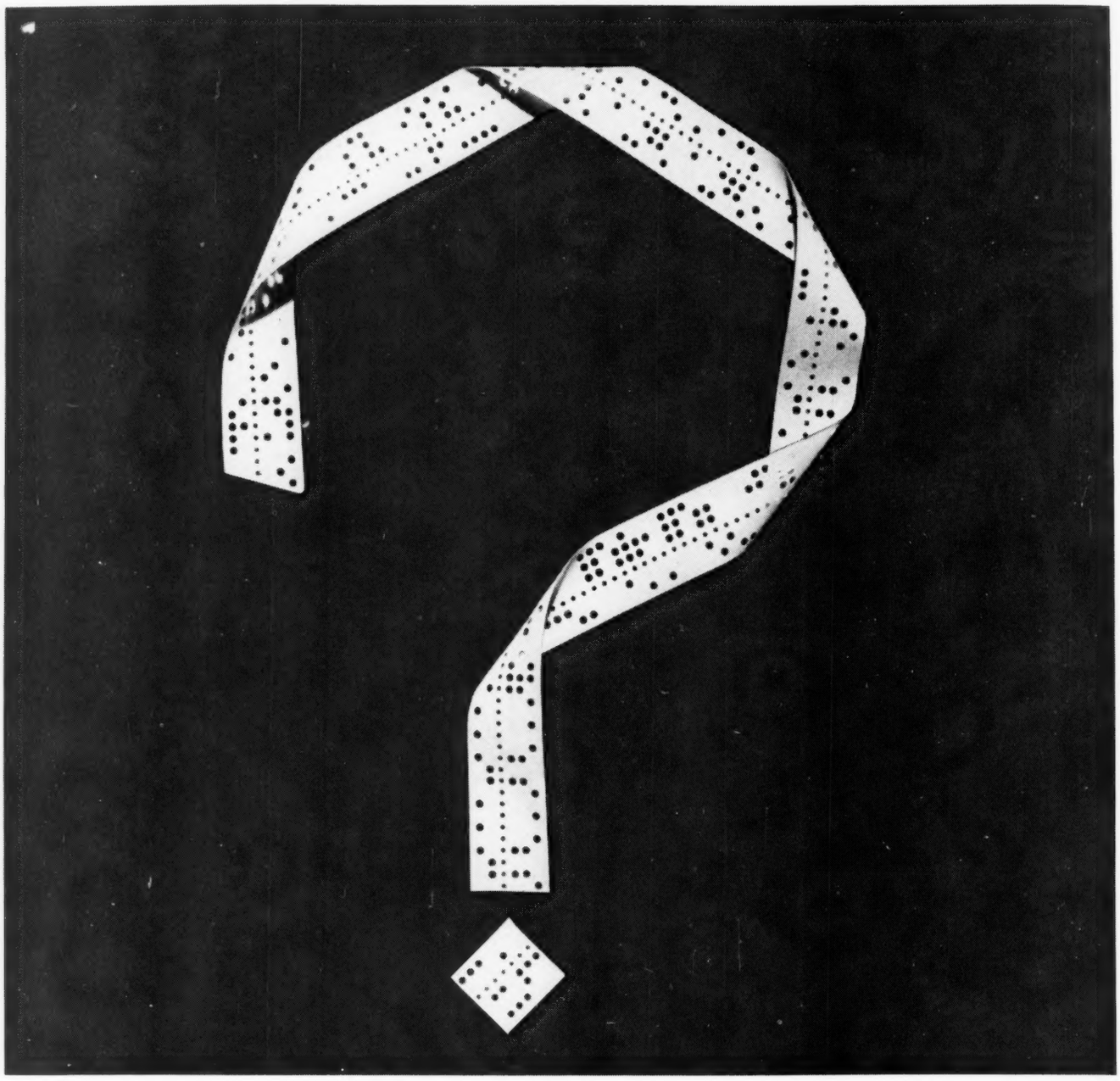
SYSTEMS AND PROCEDURES

september-october 1961

PUBLISHED BY THE SYSTEMS AND PROCEDURES ASSOCIATION



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SYSTEMS AND PROCEDURES

Volume 12 • Number 5 • Issue Number 49 • September/October 1961

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Opinions expressed by authors in this magazine are not necessarily those of the Association.

Published bi-monthly and copyrighted 1961 by Systems & Procedures Association
817 Penobscot Bldg., Detroit 26, Mich.

Subscription rates: Two years $12.00; one year $7.50; single copies $1.50. Foreign rates: $14.00, $8.50 and $1.75. (Each member receives a subscription as part of his dues.)

Second class postage paid at Detroit, Michigan.
Printed in U.S.A.

Advertising rate card available upon request to the Chairman, Advertising Committee.

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Integration of Dynamic Innovational Functions for Corporate Survival

The survival of some corporations may depend on their sensitivity to the new dimensions in management

Edward A. Tomeski

● A number of significant trends are manifesting themselves today in American corporations. These trends could result in new and drastic reorientations for executives. The results produced could prove traumatic for the inflexible managers and disastrous for the immobile enterprises and stagnating industries.

The World in Change—Can We Meet the Challenge?

The tempo of material progress and change is increasing at a somewhat prodigious rate. This relates to the tremendous social upheavals that find the backward regions of the world striving for a greater share of the world's wealth. As demand and innovation accelerate at rates undreamed of in former years, competition becomes keener. Only the efficient and imaginative corporations will prosper from the economic explosions that are occurring. Indeed the quickened pace will probably hasten the death of the marginal corporations and industries that cannot adjust to the new worlds that they will face. The stagnating corporation or industry that might have died slowly and gracefully over a period of decades in the early Twentieth Century may be exterminated in several years in the future economic world. An economic decade of the past may be equivalent to a single year in the future. (See Exhibit I.)

The Weaknesses in Our Corporate Armor

Consumer tastes are less easily defined with surety, products are threatened with quickened obsolescence, and the fund of technology and information seems to know no point of saturation. In this world of change and challenge the American corporations seem to have been quite slow to respond to stimuli. Perhaps this is the penalty of largeness and largess. Some American corporations, slow afoot, have seen relatively small but mobile competitors spring up both at home and abroad to fill market needs. Some American corporations, with vast wealth,

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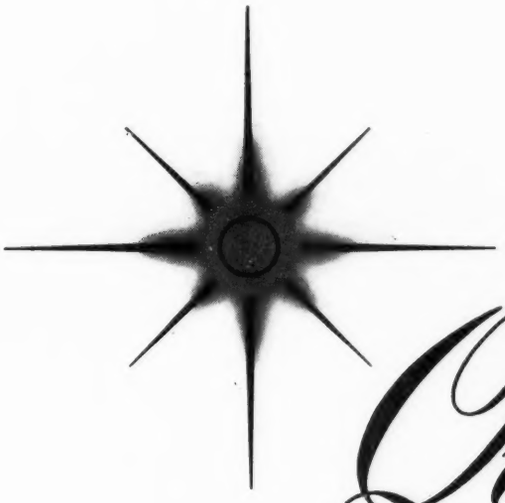
Mr. Tomeski has written articles on data processing, information systems, and operations research and has lectured at professional meetings. He is a member of the Lincoln Square Chapter of the Systems and Procedures Association. He is also a member of the American Association for Advancement of Science, Operations Research Society of America, The Institute of Management Sciences, Association for Computing Machinery, American Documentation Institute, and Management Dynamics.



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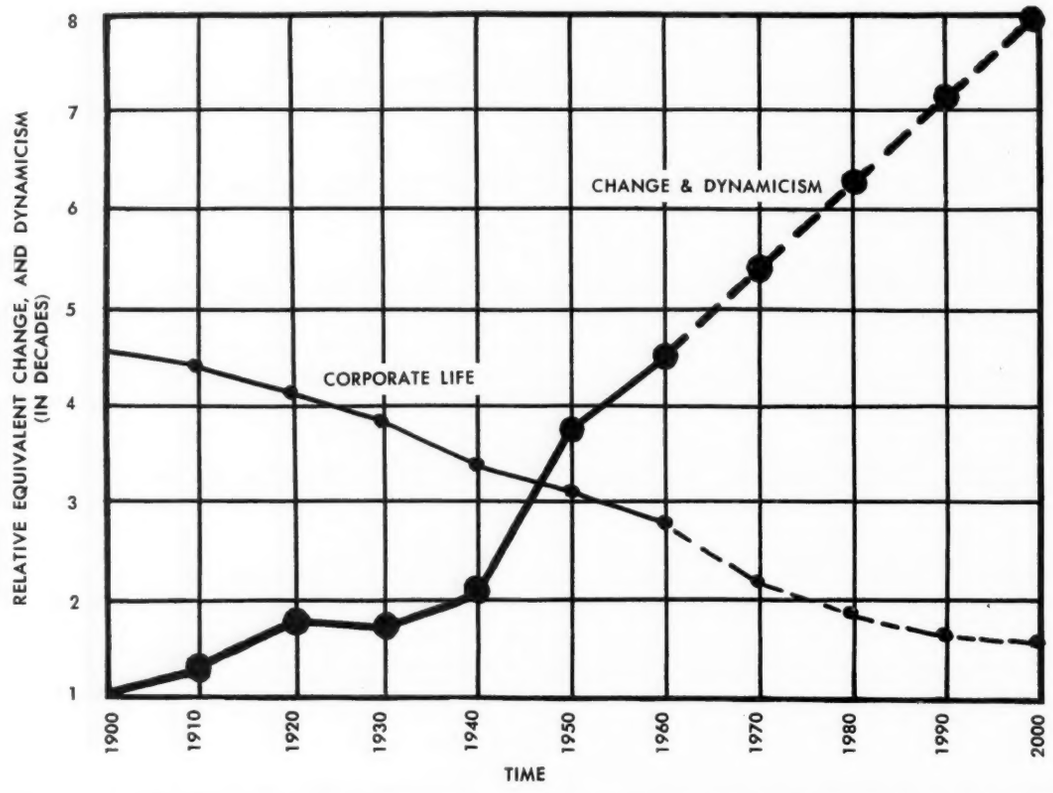


EXHIBIT I—The Relative Acceleration of Time—The Life and Death of Corporations and Industries

know how, and strength, have not used their resources to maximum advantage. Those corporations that wish to avoid the penalties of largeness and largess will probably have to take daring and unconventional steps—daring and unconventional by corporations' standards of today.

Some of the most harmful of the existing corporate faults are: stereotype thinking in terms of archaic functionalization, atrophied interest in the corporation as a whole, the apparent disappearance of the dedicated personnel, lack of administrative imagination, restrictions on organizational creativity and initiative, and extreme slowness to respond even to rather obvious stimuli. These faults, often fostered by employees who claim to have the best interest of the company at heart, are leading many American corporations down the road to self-annihilation and are necessarily weakening the entire fabric of American industrial strength.

The Slow Response—Some Bitter Medicine

The persistent trend towards increased and more effective automation continues unabated.

Research and development, presaging an era of constant change and complexity, will increasingly outmode the constants of life. The luxury becomes a necessity; the so-called necessity is severely altered or displaced by a radically different product.

The acceptance of the unorthodox and the non-conformist grows by default. This acceptance is partially based on the premise that the greatest rewards often reside where the greatest risks are and these opportunity-risks are probably most likely to exist in the unconventional.

There is a growing awareness of the limited pool of executive and technical talent that is available. This talent, the intellectual reservoir, is almost by necessity being concentrated in corporate headquarters. This is encouraging a swing of the pendulum back to the concept of centralization. This tendency is aided and abetted by technological advances in the fields of data processing and data transmission, which will shortly permit almost instantaneous flow of data from any remote place in the world to world-headquarters. This, to a significant extent, permits the centralization of planning and

decision-making that would have seemed to be totally impractical for a far-flung organization just a few years ago.

The growing importance of flexible executives who combine both the scientific approach and practical know-how is becoming more evident. The almost religious absorption of some scientist-managers in esoteric concepts, while ignoring profits, is coming under increasing fire. On the other hand, the manager who always flies by the seat of his pants is quickly becoming passe.

The race for world markets and people's imaginations will require that the American corporation sharpen its technological and managerial tools. In recent months America has witnessed a number of significant setbacks in the world's economic and political arenas. Time is short; our adversary is adept.

The Urgent Need—Fast and Effective Response

What are the urgent needs in the new business world? First and foremost, the key human beings who comprise the corporate intellectual reservoir must think and act in the best interests of the totality of the organization. This increases the need for centralizing or closely controlling all important plans and decisions that have significant impact on the overall organization. The best plans and decisions can be made by the best corporate talent, particularly if they are sensitive to company-wide needs and are free from isolated organizational pressures. Next, is the need for a more dynamic utilization of advanced tools and techniques to solve the increasingly complex corporate problems. This dynamic utilization of tools, techniques, and talents will, in some cases, require modifications to traditional organization structures. Only by using the best mix of the available tools, techniques, and talents will the corporation obtain best results. Finally, there must be a willingness to abandon traditions, preconceptions, and competitive conformity. There is an urgent need for quicker corporate response times and acute alertness to needs for changes. Organizational mobility, flexibility, and sensitivity must increase.

Avoidance or significant compromises of the above principles of survival may invite the demise of the corporation with its concomitant impact on its employees. Self-interest alone should encourage managers and employees to study closely the principles enumerated above. In the final analysis, all corporate organizational structures, plans, and actions should be the most effective alternates available to:

1. Offer maximum survival chances for the corporate entity.
2. Encourage maximum profits, over a given period of time, for the corporate entity.

All other traditions and predispositions, even if expounded in THE management text books, are superfluous if they run contrary to the two basic guidelines of corporate life.

A First Step—Integration of Dynamic Innovational Functions

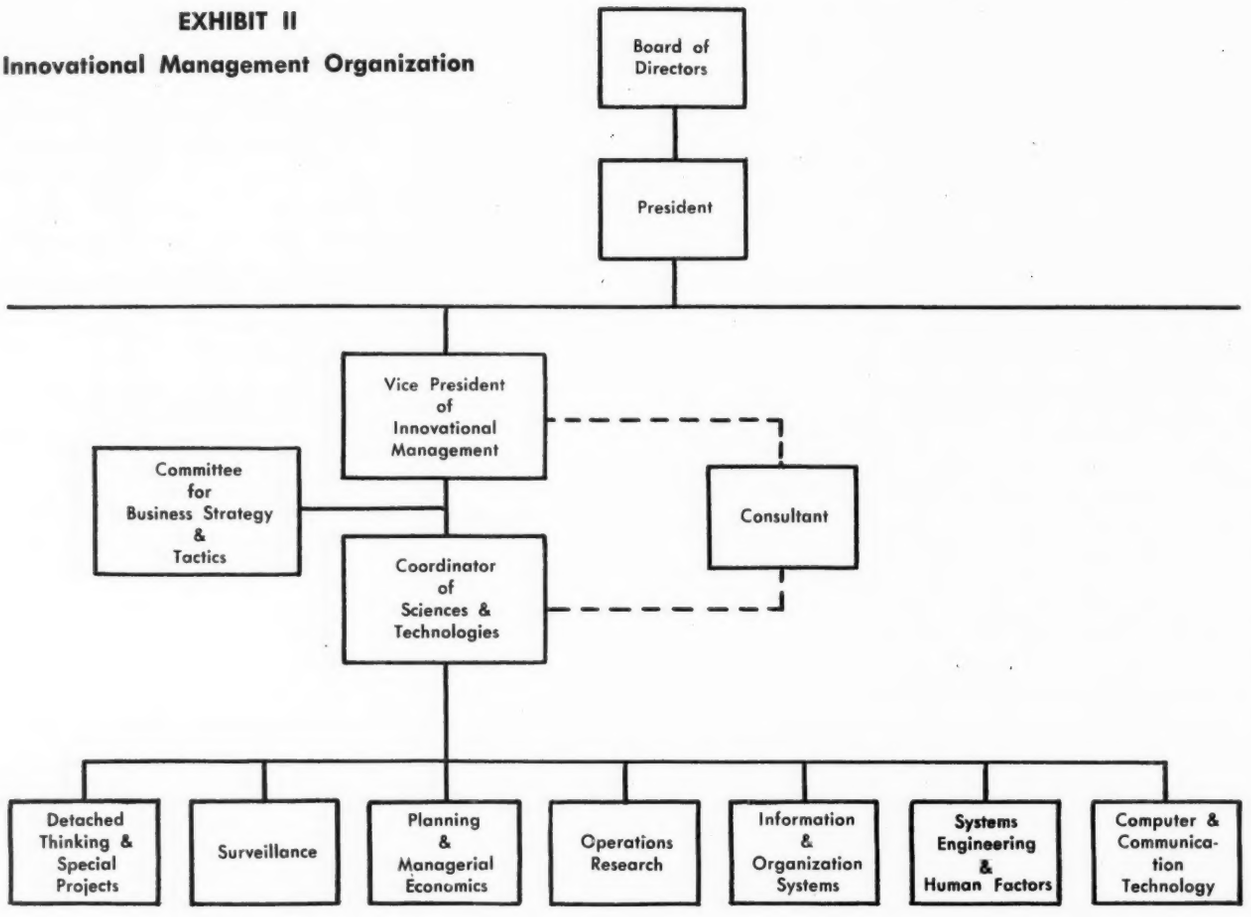
There is increasing necessity to develop and effectuate a more dynamic and daring program of planning and action. The innovational functions of management, which may include operations research, managerial economics, information systems, systems engineering, among others, are relatively young disciplines. In many cases, if not most, they have yet to prove their significant contribution to the two important corporate yardsticks of sales and profits.

The innovational functions of management are defined by the fact that they must cross traditional functional lines since their products are integrated ideas. The stagnation or stability factors in the innovational functions are at a minimum and obsolescence is an objective rather than a fear.

There is great need to integrate and unify the innovational functions, which may be called the management sciences and technologies. The unification and integration of the analytical disciplines is necessary to blend effectively the highly theoretical with the more practical activities. This is essential to obtain maximum results from the disciplines which supposedly cross departmental lines and which have as their mission, changing the existing corporate face or pioneering in uncharted areas.

EXHIBIT II

Innovational Management Organization



The corporate decision-makers require the support of the technical talents and ideas of specialists and generalists from the management science and technology groups—combined they comprise the corporation's intellectual stream. An integrated and unified corporate management science and technology group would be in the best position to provide top management with best plans, information, and alternatives. Top management would combine its judgment with the business sciences output and arrive at best decisions.

It appears that the organizations that have embarked on programs in the area of the management sciences and technologies have done so in less than coordinative fashion. The results have been less than desirable in these cases. One of the major faults probably has been the lack of meaningful organization structure and concerted effort.

The expected results of the unification and integration of the management sciences and technologies would be as follows: fixing of decision-making responsibility, integration of corporate business science planning, interrelating theoretical and pragmatic analysis, elimination of duplication of effort and uncoordinated programs, creation of delineated objectives, and potentially greater acceptance and results through group dynamics.

If the dynamic innovational functions of management are not integrated, counterbalancing the practical and the theoretical to create a more effective organization, it is likely that a number of the individual disciplines will eventually fall into disrepute. (See Exhibit II.)

The Technological Breakthroughs that Permit Centralization of Critical Responses

The complexities of business are growing and many conventional norms of organization are becoming less useful. The need for consolidated and concerted corporate-wide top level planning and decision-making is becoming more acute and more practical.

The centralization of planning and direction is necessary to insure that all important decision elements are in harmony with the optimized corporate goals. Decentralization of planning and decision-making, on important matters relating to the corporate-wide structure, can create severe weaknesses in the organization even though the local group may have been best served. Local planning and decision-making have traditionally been justified by mentioning that local management could best evaluate happenings and needs in specific geographical regions. In addition, human-relations/management development has been cited as another reason for decentralized planning and decision-making.

The rapidly increasing developments in the fields of automatic data acquisition, data transmission, and electronic data processing and computers, tend to minimize both time and distance as justifications for decentralization of planning and decision-making. Certainly the human relations/management development factors are important, but they probably are quite secondary to the primary corporate goals—survival and profits. Thus, the practicality of centralizing top level planning and decision-making, to insure best corporate-wide performance, will be assisted by the gradual disappearance of distance and time as impediments.

This will permit even far-flung corporations to use their best corporate planners and decision-makers, supported by the most advanced tools, techniques, and talent, for all important organizational matters. Only by doing this will the corporation maximize assurance that it is obtaining the best management outputs (plans and decisions) in consonance with overall organization objectives.

The growing vitalness of the data capturing, data transporting, and data handling systems is so apparent that all major corporations are striving, no matter how haphazardly, toward an organization information system concept. Many organizations are doing this, almost unknowingly, with a sense of real urgency. The network of corporation data systems, which will eventually become information lifelines, should be developed with corporate-wide objectives in mind in order to insure an integrated, reliable, compatible, and efficient complex. Few areas of the corporation require a centralized long-range master plan more than this information lifeline.

The data capturing devices will encapsulate data at the point of origination, permitting it to be automatically manipulated from that stage until the end of its usefulness when it will be stored or destroyed. The encapsulated data will be transported or transmitted, instantaneously if it is economical, to a data processing sub-center. At the center the data, which might reflect a transaction that occurred minutes or seconds ago, will be automatically manipulated to produce desired results by electronic data handling and computing equipment. The data-processing subcenters will be linked with a central data-processing office containing a large-scale computer which will be able to perform extraordinarily fast and complex operations to provide management with timely and useful management information. Such a system, which will reflect a minimum time lag from point-of-transaction to point-of-final-processing, will be a necessity in the corporation of tomorrow just as it is necessary, for survival, in some of our military organizations today, i.e., Strategic Air Command. (See Exhibit III.)

Conclusions

The very existence of some corporations, particularly those in quickly changing and/or competitive industries, may largely depend on their sensitivity to the new dimensions in management that are evolving. It is not unlikely that some corporations and industries will have to take dynamic and drastic steps if they are to retain a semblance of their positions in the economic world.

One of the most important areas of management, in this dramatically changing corporate world, is that of the innovational functions. The innovational functions, which include the management sciences and technologies, combined with the executive decision-makers will largely determine corporate success or failure. The economic environment requires that the best possible

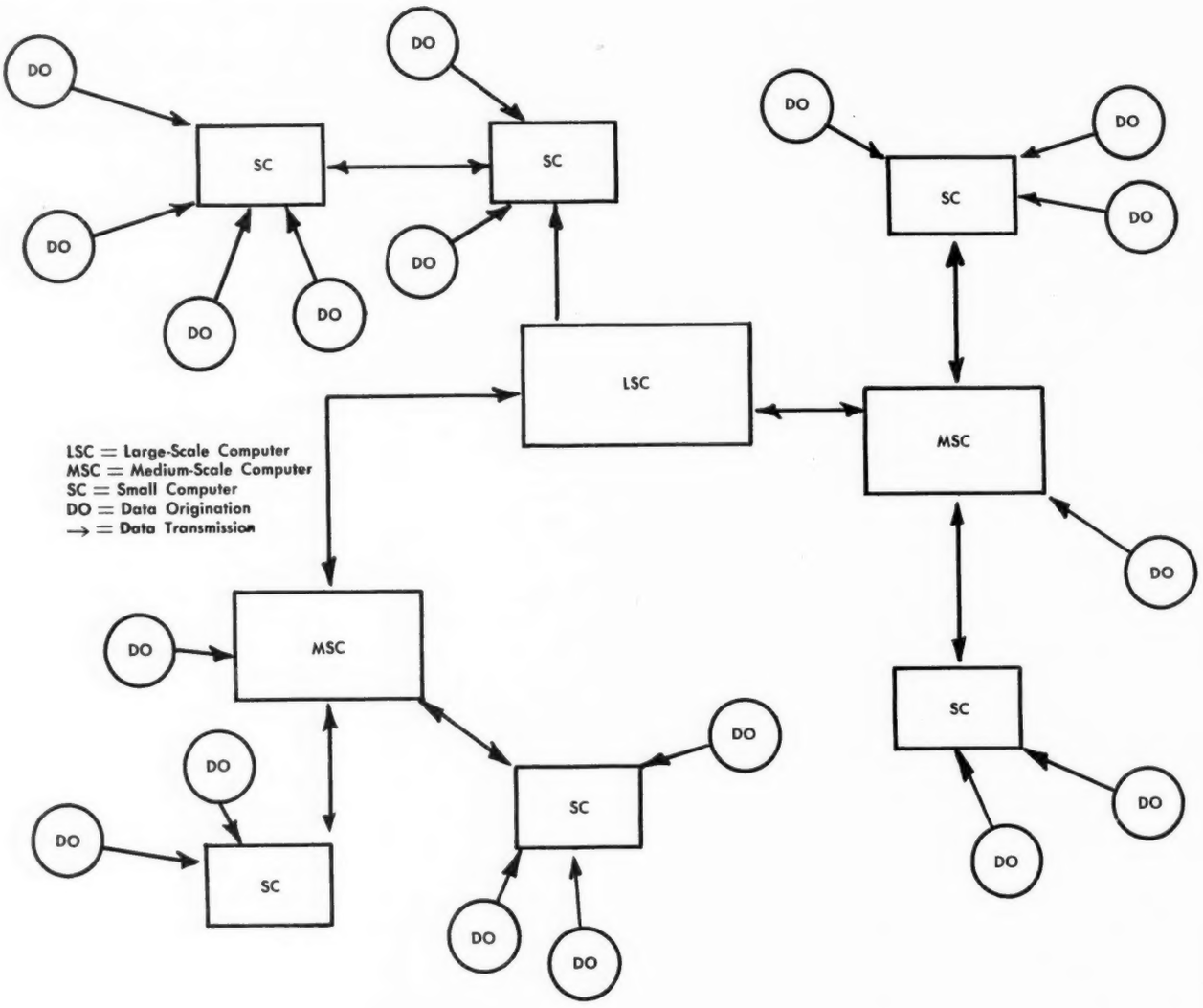


EXHIBIT III—Information Network

corporate planning and decision-making be used utilizing the best mixture of the tools, techniques, and talent that are available.

Advances in automatic data acquisition, data transmission and transportation, and data processing, are overcoming many time, distance, and complexity limitations. These advances make it increasingly desirable and practical to think in terms of centralized planning and decision-making. This will tend to reformulate thinking about decentralized planning and decision-making. Such a centralized innovational and decision-making organization will be highly dependent on a network of data systems which will serve as its instantaneous information lifeline for the corporation. It will be mandatory that this network, the lifeline, be an integral part of a master plan that fits the corporate optimized objectives.

Corporations must become more receptive to new ideas and actions that are more consistent with the rapidly changing world. Further, they must anticipate the future course of events and at least stay abreast of their times. The corporations that survive the world-wide explosion will begin dynamic and dramatic programs to face the changes and challenges inherent in new environments. These changes and challenges will include new dimensions in management that require flexible and imaginative thinking. The corporations that cannot adjust will diminish in stature or die. **s/p/a**

Profiling Knowledge in Business Systems

In classifying the field of management systems, we should extend our intellectual effort by a multiple view of the field

Adrian McDonough

● The philosophers have told us that there is no knowledge unless there is structure — a combination of elements into meaningful relationships. In the language of management, knowledge is demonstrated as man is able to organize the elements of resources into surplus-creating units and these units into larger groupings until the structure of an organization for a particular purpose is identified. In management systems, as with any field of knowledge, the elements must be identified in the context of ultimate purpose. The allocation of resources in specific situations requires careful understanding of the purposive nature of the organism under consideration.

Norbert Weiner has said that an organism can be identified by its ability to accumulate, transfer, use, and store knowledge.

The organism may be the simplest living cell which accumulates, transfers, and stores patterns of energy for some use—or it may involve the most complex operations of the universe. One challenging type is the organism which develops as man joins with others to accomplish that which he feels he cannot do alone. The range is extremely broad—as broad as the purposes for which men organize. Within the extreme range are business organisms that come into operation to provide a product or a service with a surplus, part of which can be held as profit.

In today's American society the multitude of desires for products and services reflects another complexity level of great breadth and variety—the problems of managing the businesses that produce these goods and services.

It is to a stratum of these problems that management systems are directed —to problems and associated knowledge that are generally significant for all business; a level of analysis and synthesis where the essence of thought is presented as a generalized structure and from which specific applications can be made.

. . . . about Dr. McDonough

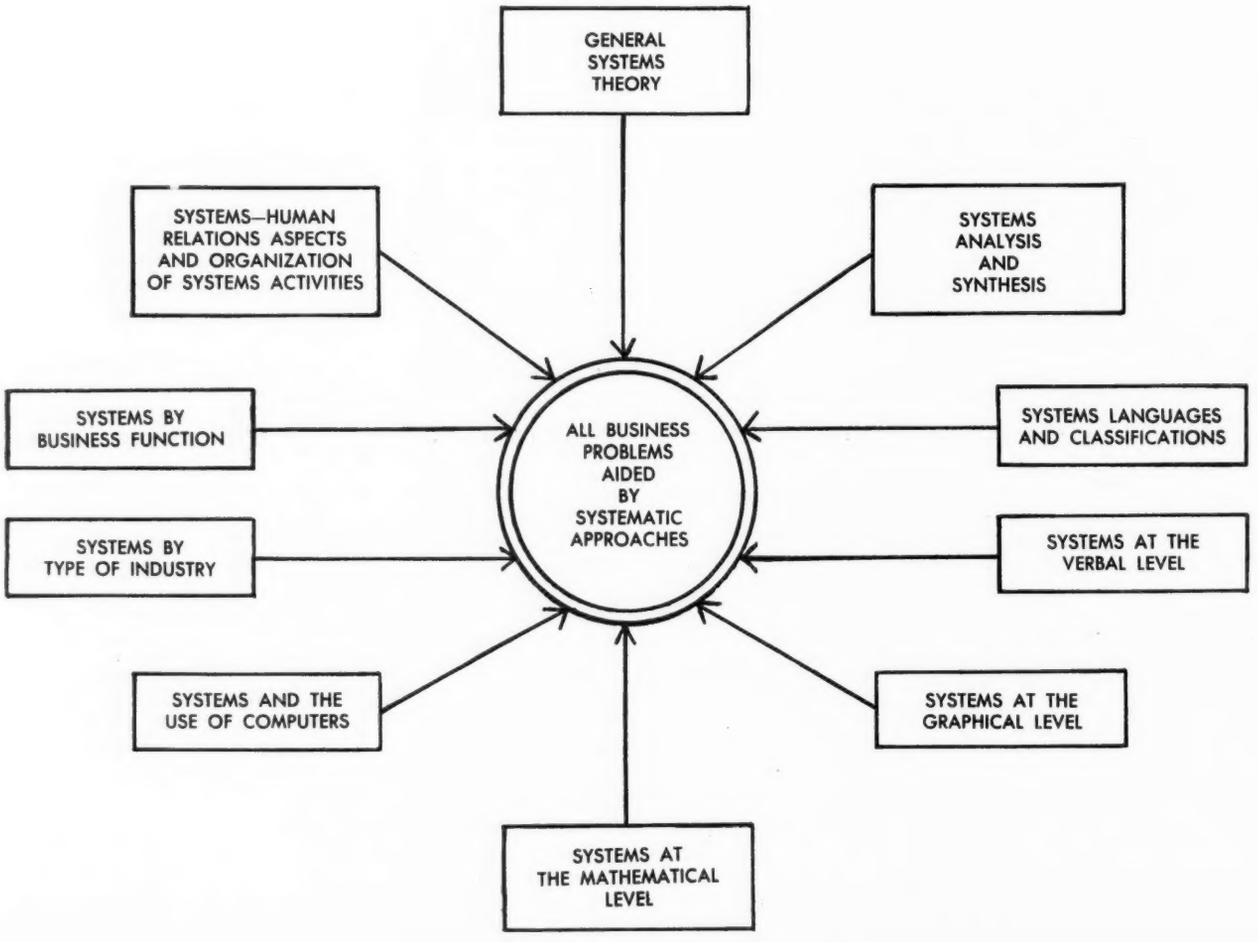
A leader in the field of management research and education, Dr. McDonough has held positions as Director of the Taylor Management Laboratory, Co-Chairman of the Industry Department and Chairman of the University Computer Center Committee at the Wharton School, University of Pennsylvania. In addition, he has directed the Wharton Refresher Conference and the Advanced Business Systems Conference. A native of Stratford, Connecticut, he received his education at the American University and the University of Pennsylvania. He has worked for General Electric, General Motors, the Radio Corporation of America, and Westinghouse. He has directed business research studies for Sears Roebuck, the U.S. Navy, the Committee for Economic Development, and the Systems and Procedures Association.

The scope and content of management systems, like all disciplines, are determined by continuing intellectual efforts of individuals seeking knowledge. It has been said that "men know boundaries; ideas do not." In any field this thought should be paramount. Only then is it possible to separate the problems of administering the field from the problems of defining a field of knowledge.

If all knowledge could be considered as finite, and especially if we could look at knowledge as small in scope, the definition of any field would be facilitated. However, scholars are conditioned to admit how little man knows of all potential knowledge. To handle such knowledge as is recognized at a moment in time, we are forced to invent at least temporary classifications and to use them as stepping-stones to greater knowledge. This is particularly relevant when business systems are being designed.

If our classifications are too broad and all-inclusive, we are in trouble. If our classifications are too detailed—again we are in trouble. Wesley Ruggles has stated this situation as follows: "Every simple classification constitutes more or less of a strait jacket. . . . On the other hand, the abandonment of a simple classification system can rapidly lead to masses of unrelated and incoherent figures."[1]

1. *A Survey of Contemporary Economics*, Homewood, Ill.: Richard D. Irwin, Inc., 1952, p. 422.


GENERAL SYSTEMS THEORY
SYSTEMS—HUMAN RELATIONS ASPECTS AND ORGANIZATION OF SYSTEMS ACTIVITIES
SYSTEMS ANALYSIS AND SYNTHESIS
SYSTEMS BY BUSINESS FUNCTION
ALL BUSINESS PROBLEMS AIDED BY SYSTEMATIC APPROACHES
SYSTEMS LANGUAGES AND CLASSIFICATIONS
SYSTEMS BY TYPE OF INDUSTRY
SYSTEMS AT THE VERBAL LEVEL
SYSTEMS AND THE USE OF COMPUTERS
SYSTEMS AT THE GRAPHICAL LEVEL
SYSTEMS AT THE MATHEMATICAL LEVEL

In classifying the field of management systems, why should there be only one way to look at a particular field or grouping of sub-fields? If the field is complicated, why not seek to extend our intellectual effort by a multiple view (and classification) of the field? Such selected multiple views can then be the basis for a compound program that is more than the sum of the contributions of the individual views. At the same time these alternatives will show that there is a natural integration between and among the parts of the field.

The diagram represents an attempt to show a selected number of sub-fields of systems knowledge. These "parts of the field" can represent "inventories" for different classifications of knowledge in the overall systems field. The content and interrelationships of these particular sub-fields have been under study in the project sponsored by the SPA Committee for the Development of Systems Courses. The results of this study are being presented at the International Systems Meeting at Cleveland, October 11-14. It is hoped that this framework will provide opportunity for a continuing and expanding inventory of knowledge in the field of business systems. **s/p/a**

Meeting Competition Through Systems

The old ways may no longer be adequate Good business management requires a sound progressive systems function

F. Walton Wanner[1]

F. WALTON WANNER, C.P.A., is a systems consultant with the Standard Oil Company (New Jersey); president and director of the Jersey State Bank, River Edge, New Jersey; and mayor of River Edge. He is past international president of the Systems and Procedures Association, Mr. Wanner is a graduate of the School of Commerce, New York University and a member of Beta Gamma Sigma and Beta Alpha Psi. He has conducted systems seminars in Europe, South America, and the United States.

1. In May, 1957, *Systems & Procedures* published Mr. Wanner's article, "Electronics Unifies Management Relationships."

● Modern American business, large and small, must not ignore the serious challenge of world-wide competition it faces today. The growing world-wide competitive market has intensified the need for us to increase productivity, decrease costs, improve the product, and maintain the profitability of invested capital. Business management must use every available means at its disposal to solve the resultant complex problems. A good hard look at long-accepted standard business concepts, ways of doing things, and the whole organizational structure of our business is essential. *The old ways may no longer be adequate.*

As always, we expect American ingenuity and skill to rise up to meet this challenge. An essential part of meeting the challenge, the writer believes, is through the intensified use of today's systems technology because it reaches into every facet of business. Properly applied, it can strengthen each part of business, so that over-all objectives may be accomplished more effectively.

Defined as "that vehicle which enables management to fulfill its organizational purpose," systems underlie and are a part of every management action, directly or indirectly, consciously or subconsciously. Consequently, the systems function has the same goals as management. It has the same responsibility as management has to society, to employees, and to stockholders, for the successful performance of internal corporate operations and for the economic welfare of the country. Good business management requires a sound, progressive systems function.

The Systems Function

Today's systems engineer is the result of a long period of growth. In earlier days, the systems man generally originated in the accounting department because of the obvious need business had for accounting systems. As business grew, clerical and paper work other than accounting grew in all departments. It became necessary, therefore, to employ systems people as overall coordinators. Since personnel with special training and experience in systems analysis and coordination were not yet available, the one selected for the work was generally an accountant; hence one can say that the early systems engineer was the outgrowth of an accounting systems man.

Today, one of the primary activities of a systems man involves data processing. Modern usage makes this area a co-partner of operations research, frequently referred to as mathematics applied to business. Today the systems engineer delves into all phases of a company's activities—administrative, corporate, and operating; and into all departments of the company — manufacturing, sales, purchasing, research, and employee relations.

Where then in a corporate organizational structure should the systems man or the systems function be placed? Because of the historical beginnings, the comptroller's department is frequently selected. This is all right if the comptroller is fully aware of the broad scope of the systems man's responsibilities, and if he is a *working* member of the top management team, not just an advisor. *A more recent trend is to have the systems function report to a top operating executive such as an administrative vice president.* In small companies, it is not uncommon to have it report directly to the president. Such an arrangement enables the systems engineer to function effectively throughout the organization, since his responsibility and authority emanate from an executive having over-all corporate administrative responsibility. In large organizations, individuals with certain systems responsibilities may be located in various departments. However, ultimate responsibility and authority must be vested in one person reporting to a sufficiently high authority to enjoy the respect of all departments in which he is called upon to operate.[2]

Integrated Systems

The importance of *collecting*, *processing*, and *reporting* information has assumed proportions today far beyond those of even a

2. For further thought about this, see the AMA Report No. 56, *Shaping a New Concept of Administrative Management.*

decade ago. Everyone is striving for *integrated* information processing systems.

What are integrated systems? *An information system is integrated when all related source data are collected, without duplication, into a common data processing operation.* This data processing service must be designed to satisfy all of management's requirements, regardless of the source of the data, the departments involved, or the present organizational boundaries. Properly identified, source data may serve multiple uses if channeled into an effectively integrated information processing system. The architect of such a system must be thoroughly informed about the company's operations, data processing, and management's needs. Complete coordination of all sub-systems throughout the company is necessary to develop a totally integrated company-wide system.

Messrs. Leavitt and Whisler[3] identify the flow, gathering, and use of information by management as "information technology." They associate it with Frederick W. Taylor's "scientific management," and the post-World War II technology of "participating management." Electronic data processing equipment, constantly improved, has played the greatest single role in facilitating the development of integrated information processing systems. The tremendous capacity of these machines has made it possible to design entirely new channels of information flow which, in turn, have brought about new problems. New ways of "capturing" transaction data at the source and of transmitting the data to a central processing point have developed new organizational philosophies and concepts, even though the equipment now available is still in early evolutionary stages. A new look at centralization and decentralization of data processing facilities must be taken.

A means of interrelating data into a common language acceptable to both men or machines is ultimately necessary. This evolution will involve data processing equipment compatibility, adequate communication and transmission facilities, and uniform format.

Systems Analysis

In order to implement the total systems concept, we can use what might be called a "systems analysis approach." The prime objectives are:

1. Develop a logical, streamlined information system which
   a. Eliminates unnecessary effort.
   b. Simplifies essential effort.
   c. Integrates related systems.
2. Structure an effective organization wherein this system can function effectively.
3. Establish manpower requirements.

Systems analysis begins by documenting all parts of a company's information processing activities. Documentation uses flow charting to identify clearly all input, all intermediate action, and all output. This permits a systematic analysis of output as related to source data input, with appropriate consideration of all intermediate processing.

The validation of output records is an essential part of systems analysis. Traditional and past requirements should not be the governing factor in determining the validity or need for output. The validity and need must be firmly established by the highest authority.

Reports

An information system consists of various types of records and reports. A sound reports program is essential to meet management's need for information. We are all familiar with the tremendous volume of historical and computed data which is transmitted from one office to another as reports—"essential" information. A study of a small group of related reports recently made by a large company indicated that 75 per cent of the information being reported by field offices to a central processing point would be

3. "Management in the 1980's," *Havard Business Review*, November-December, 1958.

unnecessary in a uniform data reporting system maintaining its own historical information. Such unnecessary and costly information processing must be eliminated by systems engineers if costs of operation are to be competitive in a world market. Marion Harper, Jr.,[4] Chairman of the Board, Interpublic, Incorporated, has recently stated "To manage a business well is to manage its future; and to manage the future is to manage information. . . . What is needed is the development of a new profession to provide management with an intelligence service for the shaping of strategy and policy." He names the head of such a service as "director of intelligence."

A Systems Engineer's Obligations

As systems engineers, we have an obligation to our profession, to our companies, and to ourselves. We have an obligation to live up to our responsibilities to management. How do we meet them?

We meet them by equipping ourselves to do the job. We keep abreast of the changing philosophy underlying the systems responsibility; we continue training in new fields; we become thoroughly familiar with new systems techniques and tools. We study the systems efforts of other companies. We work on a professional level with others in our field. We promote research and adequate education about systems tools and techniques —strive to equip ourselves to solve *real* management information problems.

We should move into the field of information processing and utilization research. We must make use of electronic data processing and operations research, for if we do not, the dollars lost can never be recovered and our position in the world market is weakened. But we must avoid overemphasis on the techniques of solving problems in corporate information processing. One can become absorbed in tools and techniques and lose sight of the basic problem. It is possible, for example, to become so entranced and involved in the technical factors of converting problems to electronic machine language that analysts may lose sight of the problem of developing an integrated system of processing information really needed by management.

Summary

It is no longer possible to accept traditional output record and report requirements at face value. It is necessary to examine and evaluate each. It is particularly essential to cull out historical and computative data, thereby reducing the data required from original source documents or from field offices. *Only information that it is not possible to maintain in the collecting and processing system or to compute at the last point within the data flow should be requested from reporting offices.*

New educational and research facilities are necessary to train personnel to handle information processing systems in the future. Our educational institutions must be made aware of the speed with which business and government management information needs and communication flow concepts are changing.

Relationships between philosophies and disciplines are coming to light which heretofore seemingly bore no relationship to business. Subjects shunned by business students in the past need to receive more attention. Subjects which may become part of the program of business education are: engineering in all its branches, economics, mathematics, sociology, anthropology, statistics, psychology, philosophy, logic, operations research, motivational research, survey techniques, and design and management of research and computing machine techniques.

Our educational facilities must take the lead in training business managers who are aware of the importance of, and who know how to use, our new systems engineering knowledge. Business, in turn, must help universities meet the challenge. The development of efficient business systems requires the cooperation of government, industry, and education if we are to safeguard and advance free enterprise. **s/p/a**

4. *Management and Business Automation*, March, 1961.

Operating the Systems and Procedures Department

PART V

A. Richard De Luca

● The manager of a systems and procedures function is faced with the same challenge as any other manager, namely, to plan, organize, direct, and control his unit as effectively as possible. His challenge is made somewhat more formidable because the goals of a systems unit are managerial improvement and the reduction of operating costs. Such goals focus the attention of all other management personnel upon the operation of the systems unit so that the systems manager must manage in an exemplary manner.

A systems manager can best meet this challenge by applying recognized and accepted principles of management. It is the writer's opinion that it is only when sound management principles and practices are applied diligently that the systems manager, or any manager, can perform effectively. This article considers performance by a systems manager, in the following sequence:

1. Preparing for Operation of a Systems Department.
2. Planning and Establishing the Systems and Procedures Program.
3. Introducing the Systems and Procedures Staff to the Company.
4. Directing the Conduct of Systems and Procedures Assignments.
5. Following-Up, Reporting, and Evaluating Progress.
6. Minimizing Deterrents to Effective Systems and Procedures Work.

1. *Preparing for Operation of the Department.*

The first task faced by a manager once he is ready to operate is that of "setting his house in order." That is, he must establish the internal operating procedures he needs to carry out each management task. These internal procedures should cover the following subjects:

a. Receiving and Recording Assignments.
b. Making Work Assignments.
c. Conducting Systems and Procedures Work.
d. Maintaining Systems and Procedures Files and Records.
e. Developing Controls Over Staff Performance.
f. Planning and Establishing a Management Reporting System.

a. *Receiving and Recording Assignments*

Since a large percentage of systems work is really generated through requests from

other departments, the establishment of a procedure for recording the receipt of such requests becomes quite necessary. The use of a "Project Register" form is encouraged. Several designs for such a record are presented in Figure 1.

b. *Making Work Assignments*

A common problem for supervisors is deciding how to distribute the work. It is desirable therefore to establish procedures which provide a plan for determining work priorities and guidelines for assigning projects and programs to systems personnel. A review of the *sources* of systems work helps provide the basis for establishing a priority scheme. The common sources are:

(1) Assignments by the president or other members of top management.

(2) Proposals by top management committees, occasionally established for the purpose of determining the areas in which systems and procedures work is most urgently required.

(3) A program developed by the systems manager and approved by his superior.

(4) Requests from operating managers.

(5) Audit reports.

(6) Observations of the systems and procedures staff.

(7) Suggestions from operating personnel.

The sequence in which the above sources are listed might well serve as a "Priority Schedule" for the systems manager. The establishment of a clear-cut schedule will minimize disputes and simplify decisions about assignments to members of the systems staff. The following factors are helpful in deciding to whom the assignment should be made.

a. The type of systems talent required to handle the assignment. The manager should ask himself, "Who on my staff is best qualified in terms of background and experience to handle this particular job?"

b. The scope and size of the project. Can one analyst handle the assignment effectively within a reasonable length of time or will a *team* produce better results?

c. The present workload of each staff member. (The creation and use of controls by the systems manager are discussed later in this article.)

While it might be difficult for the systems manager to prepare a standard operating procedure to cover making work assignments, he might issue a statement of policy to explain it. One such statement actually in use reads as follows:

> *Relationships within the Systems and Procedures Department*
>
> All members of the systems and procedures department will work together closely. Although three separate areas of responsibility have been defined (office and accounting procedures, measurement, and mechanical and electronic data processing), members of all three sections will probably consult together on most projects. Leadership in a particular project will be assigned to that section having major interest in it. In each project, the first step will be to define the problem and identify the objectives. This initial step will help to determine which section of the department should assume leadership in the project. In setting the objectives, corporate objectives of uniformity, comparability, and efficiency will be considered in addition to the local objectives of the department or plant directly involved. The section to which the problem is assigned will determine and put into writing the current procedures and will design a new system to achieve the objectives set forth. In designing the new system, the conference method will be used to permit other sections of the systems and procedures department and the supervisors of the department, in which the study is being made, to participate. Once the overall system is designed, the detailed procedures will be developed by the applicable sections of the systems and procedures department. This will include determination of methods, forms design, mechanical or electronic data processing equipment, etc. In this work, each section of the department will work primarily in its own specialized field.

c. *Conducting Systems and Procedures Work.*

Since most systems and procedures work is not routine, it is impractical to develop a

FIGURE 1

Project Register

Date	Project No.	TITLE	Analyst	DATES					REMARKS
				Start	Proposal Report	Issued	Installation in Process	Project Completed	

Source: Barish, p. 279.

Project Control Board

Project No.	Start Date	Project Title	Analyst	Survey Finished	PROGRESS					EST. Completion Date	REMARKS	Last Check
					Plans Outlined	Proposal Prepared	Approval	Installed	SPI's Written			

Source: Neuschel, pp. 100-101.

Project Assignment Register

Analyst						☐ Active ☐ Completed ☐ Pending	Facts	Draft	Comments	Final draft	Typing	Approval	distribution	Page of		Date
J.D.	E.M.	B.J.	R.F.	M.G.		TITLE								Due Date	File No.	Date Completed

Source: J. T. McGovern, "Reporting and Handling Project Priorities", Systems and Procedures. (February 1960), pp. 35-37.

set of "standard operating procedures" for the staff. It is, however, both feasible and desirable to develop an *Operating Manual.* Such a manual should contain the following information:

Contents of a Systems and Procedures Operating Manual.

(1) Recording and Reporting Workload. This section might act as a sort of "standard operating procedure" for analysts and contain instructions and illustrations concerning the maintenance of workload control forms and records.

(2) Getting Management Support. A systems analyst must practice good psychology at all times. It is important, therefore, says Richard Neuschel,[1] "... for staff members to understand clearly the nature of their task. Their's is a twofold job. It is not merely a matter of generating sound ideas through a skilled, technical approach to problems. It is just as much a matter of gaining acceptance of those who will put their ideas into practice..."

(3) Staff Relations with Managers and Operating Personnel. Some tips about good human relations should be included in the manual. The importance of encouraging *participation* of operating managers and personnel should be stressed.

(4) Understanding the Role of Staff. Educational material about staff anticipation, completed staff work, and other related subjects will be useful, particularly to help each analyst understand better what his relationship with *his* superior—the systems manager—should be.

(5) Conducting a Systems Survey. A detailed presentation of survey techniques *must* be included in the systems manual. Such a section usually instructs the analyst in the use of flow-charting and provides him a step-by-step explanation of a survey procedure consisting of the following phases:

(a) Definition of the problem and identification of the objectives of the study.

(b) Accumulation of pertinent data on a departmental or functional basis, and the preparation of written procedures, graphs, or flow charts.

(c) Development of recommended procedures; including operating instructions, forms design and development, and equipment specifications.

(d) Installation of accepted procedures, including the training of personnel.

(e) Review of results after a reasonable period of time has elapsed since the installation of the procedure.[2]

(6) Work Simplification Fundamentals. A detailed treatment of work simplification should be included. Some manuals incorporate work simplification into a section dealing with conducting a systems survey. The material should be so arranged that a systems analyst can use it to instruct management personnel in work simplification principles.

(7) Procedure Writing Guide. A section on how to write a procedure is important. It is axiomatic that the major product of a systems and procedures staff—written procedures and policy statements—should be standardized in form and style and clearly and concisely written.

(8) Checklists. The manual should contain checklists which analysts can use as guides in investigating, analyzing, and evaluating organization, forms, records, personnel, procedures, reports, and equipment.

1. Neuschel, p. 82. (Complete footnotes are given in previously published parts of this series.)

2. *Workshop for Management,* (8th), p. 153.

(9) Installing and Implementing Systems and Procedures. It may be possible to include in the operating manual a standard procedure for installing and implementing systems and procedures. It is *extremely* important for an analyst to receive sufficient guidance in accomplishing this important phase of his job.

(10) Reporting Progress. Here again, a standard guide for the analyst to follow in reporting his progress—or lack of progress—should be developed if possible. It will help the analyst maintain good lines of communication with his superior. Some systems managers admit that they frequently lose contact with some of their analysts; these systems managers rely extensively upon informal reporting methods.

(11) Follow-Up. Systems personnel seem to be historically negligent about follow-up. For this reason firm instructions about follow-up procedures and techniques should be part of every systems and procedures operating manual.

(12) Systems Research. An increasingly important part of a systems analyst's job consists of the *research* he must conduct during the fact-finding and analysis phases of his assignments. Effective research techniques must be learned. It is this writer's contention that a little extra effort by a systems analyst in learning how to handle *research* will help him to be more effective in his work.

d. *Maintaining Systems and Procedures Files and Records*

The files and records of a systems and procedures department should serve as active and useful reference matter. All of the record-keeping can usually be restricted to the following types of files:

(1) Procedures File: Drafts, approvals, correspondence, worksheets, and other material pertinent to each procedure worked on or published by the systems staff.

(2) Project File: Similar material relating to projects such as organization reviews which might not be classified as procedures.

(3) Forms File: A copy of every form used in the organization.

(4) Systems Library: Reference material, including catalogs, articles, books, magazines, notes, and products of other systems groups.

It is important that the systems manager instruct his staff in gathering data systematically and neatly during the course of each investigation. At the conclusion of a study, a systems analyst should assemble his worksheets and other data into a project folder. When properly indexed and filed, these records provide valuable reference information and help to answer questions about work in process.

e. *Developing Controls over Staff Performance*

Developing controls over staff performance encompasses three major activity areas:

(1) Establishing workload controls.

(2) Developing a status-reporting system.

(3) Arranging for periodic staff meetings to maintain an integrated operation.

In order to control workload, a supervisor must establish control of input, in-process work, and output. Techniques for handling the receipt of work and the determination of priorities were discussed earlier. We can continue here then with the problem of systematically assigning the work, supervising its progress, receiving feedback from the analysts, and adjusting workloads accordingly. This problem is well stated by Neuschel.[3]

"One of the conditions peculiar to the operation of most staffs is the high degree of variability in their units of work. . . . No two of its projects are alike in scope, in the conditions encountered, in the time required for

3. Neuschel, pp. 98-99.

PROJECT STATUS CARD

Program | Project

Analyst

Per Cent of Progress: 25 | 50 | 75 | 100

Begin. Date

Target Date

Purpose and Scope of Project:

Statistical Data Required & Source of Data:

Condition Necessitating Project:

Type of Presentation:
- ☐ CHART — Other (specify)
  Prepared by: _____
- ☐ Tabulation
- ☐ Written Report

Project Status Card

(Front)

Results of Project			
Savings	ANNUAL RATE		Other Savings and Improvements:
	Quantity	Cost	
Man Hours			
Floor Space			
Equipment			
Forms			
Reports			
Postings			

(Back)

Source: Shell Oil Company Staff Manual, page 2.11

FIGURE 2

SUBTRACT QUANTITY-SOLD FROM BALANCE-ON-HAND. IF BALANCE-ON-HAND IS NOT LESS THAN REORDER-LEVEL THEN GO TO BALANCE-OK ELSE COMPUTE QUANTITY-TO-BUY = TOTAL-SALES-3-MOS/3.

THE LANGUAGE ABOVE IS COBOL ... COMMON BUSINESS ORIENTED LANGUAGE. IT LETS YOU GIVE YOUR IBM COMPUTER INSTRUCTIONS WITH WORDS THAT CLOSELY MATCH EVERYDAY BUSINESS LANGUAGE. THE BENEFIT -- HOURS, DAYS, WEEKS OF TIME SAVED BY ELIMINATING DETAILED MACHINE LANGUAGE INSTRUCTIONS LIKE THESE:

06000	?	12048	12047	06096	'	12042	
06011	'	12040		06102	?	12017	12046
06017	?	12007	12043	06113	@	12013	12047
06028	@	12002	12047	06124	H	12042	
06039	C	12047	12049	06130	?	12047	12022
06050	J	06068	U	06141	'	12043	
06057	A	12050	12046	06147	?	12012	12047
06068	H	12040		06158	S	12022	12047
06074	?	12046	12012	06169	H	12043	
06085	?	12048	12047	06175	?	12047	12027

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completion, or in the character of results achieved. There are no regular, daily tasks for the staff to perform, nor are its members normally subject to close supervision. Their work is essentially that of examination, diagnosis, and deliberation—all mental processes for which there are no ready standards of measurement.

"For these reasons it frequently happens that little or no effective control is exercised over staff performances—either quantitatively or qualitatively. Yet, the very circumstances that make the exercise of such control difficult, also increase the need for it. Without some systematic means of checking the entire staff's work, it is not reasonable to expect that its members will continuously put forth their best efforts or that an adequate basis will be provided for strengthening their performance.

"Control should be exercised over the following three phases of the staff's operation: (1) work undertaken; (2) progress of each project (the quantitative element); and (3) results achieved (the qualitative element)."

Assignment sheets (See Figure 1) used to control the input of projects have the following advantages:

(1) Force the manager, at an early stage to consider the objectives, scope, and cycle-time required for a project.

(2) Require the analyst to pre-plan his assignment and to review his methodology with the systems manager. The resulting conference helps to make the manager a more effective *leader*, and motivates the analyst to improve his performance.

(3) Establish estimates and a target date, thus motivating the analyst to plan his daily work more carefully and providing him with a bench mark against which he can check his progress.

Systems personnel should be required to maintain daily work records of time spent on each assignment and information about other activities carried on in the course of the work. These records can be used to estimate the hours spent on each project, for comparison to original estimates. They also provide the systems manager with a basis for evaluating the effectiveness of his staff members.

Project Status and Summary Records (See Figures 2 and 3) enable the systems manager to review and evaluate progress, determine costs and accomplishments, and in turn develop reports for management.

f. *Planning and Establishing a Management Reporting System*

Records a systems manager creates to control staff performance serve also as a source of information for reports which he submits to apprise his superiors of progress, problems, and plans for the future. He can anticipate and facilitate such reports by acquainting his analysts with the preparation of management control reports and by requiring them to submit periodic time utilization summaries. Such reports depict the history and long-range *trend* in an analyst's use of time and serve also as excellent bases for discussions and performance evaluations.

What information should a systems and procedures management report contain? Systems managers have frequently cautioned against overemphasizing *cost savings* incurred through the staff's efforts. This point is well taken, since much of the total systems effort results in intangible, difficult-to-measure types of savings such as improved management intelligence through better reports, reduced cycle times, and strengthened internal controls.

Certainly, all benefits produced by a systems and procedures staff group should be reported. A picture should also be supplied to management of current work-in-progress: What projects are in process, what they are expected to accomplish, and when.

An important aspect of a systems and procedures staff report is that of *constructively criticising* management practices which the systems and procedures group has found to be deficient or weak. If the group is to accomplish its objective of developing an integrated, unified organization, it must be allowed and even encouraged boldly and fearlessly to expose the weakest links in the

PROJECT STATUS AND SUMMARY RECORD

Project Name		Project Number
Originator	Date Rec'd	Est. Man Days
Scope & Purpose: (Front)		

PROGRESS	Schedule			Actual	Man hrs.
1. Start Investigation					
2. Complete Investigation					
3. Complete Report, Recommends					
4. Complete Procedure(s)					
5. Complete Indoctrination					
6. Complete Installation					

ACCOMPLISHMENTS:

(Rear)

COST SAVINGS:	COSTS OF PROJECT
Labor	Analyst Time
Material	Other Personnel Time
Rental	Materials Used
Floor Space	Special Expenses:
Total Savings	Total Costs

Net Gain/Loss 1st Year $_____. Annual Savings Thereafter $_____

Source: Adapted from description given by Norman N. Barish, Systems Analysis For Effective Administration. Funk & Wagnells, New York, 1950, pp. 279-280.

FIGURE 3

organizational chain, with the intent not to destroy but to develop and improve.

Written reports of themselves are not really adequate. Many systems managers prefer to supplement periodic reports with verbal reports and consultations. During such conferences, management is most likely to review such factors as:

(1) Is progress satisfactory?

(2) Do any major plans or programs require revision due to recent changes in management thinking?

(3) Is there any new problem area which requires attention? What is the priority?

2. *Planning and Establishing a Systems and Procedures Program*

The importance of a *planned* program of systems and procedures development cannot be overemphasized. It is only when a carefully planned program is maintained that "emergency" or "unplanned" jobs can be handled adequately and that overall progress toward fundamental goals can be controlled and properly estimated.

A good systems program is characterized by balance, diversity, flexibility, and completeness.

A systems program must be initiated as a considered and deliberate act of top management. If abandoned after a short period of time because of less spectacular results than anticipated, it can do a company more harm than good. The staff should get a fair chance to do an effective job. This responsibility imposes two requirements on top management:[4]

a. Management must first give the procedures staff sufficient time to prove itself. The newly established staff is confronted with a major task of gaining the confidence of operating personnel. If the staff was recruited from company personnel with the proper basic qualifications but with limited experience in procedures analysis and design, it will also be faced with the job of developing a certain amount of technical know-how. There are few short cuts it can take in achieving either of these goals. Both are essentially a matter of education, and education is a slow process. But until both are achieved, *the procedures program itself cannot be hurried without inviting failure.* (This writer's emphasis.)

> . . . management must come to understand that if the procedures staff is to build soundly, it must be given the chance to build slowly. Its performance during the first year or two of operation should be judged not so much by the number or importance of projects completed as by the progress it has made toward developing sound relations within the organization. During that period the staff members will likely make a number of mistakes. How serious these mistakes are should rest not so much on their immediate significance as on whether or not the staff members readily recognize, admit, and profit by them. Unless the top-management group is sufficiently serious in its intent to adopt and hold to this long-range view, it would be better never to undertake a planned procedures program. To start the program and abandon it within a year for want of spectacular results would, in all probability, do more harm than good.

b. Giving the staff a fair chance to prove itself requires next that top management take the steps necessary to facilitate decision-making. This is a matter (1) of working out with divisional and departmental executives a simple but adequate pattern of approvals required on procedure recommendations, and (2) of "keying up" the organization to reach decisions on such proposals within a reasonable time.

3. *Introducing the Systems and Procedures Staff to the Company*

A systems and procedures staff can be introduced to a company in one of two ways:

a. Prepare and circulate an announcement which introduces the staff and explains its objectives and relations with *all* personnel and solicits the cooperation and *participation* of all company personnel in accomplishing the objectives.

4. Neuschel, pp. 84-86.

The announcement which introduces the staff might include information about how the systems unit was organized, an organization chart showing its unit structure, a brief introduction of the unit's personnel, a simple narrative explanation of how studies will be processed, and some information about the role to be played by *all* company personnel in the development of the systems function.

The president of one organization introduced his new systems unit through a series of letters to all management personnel, one of which read in part as follows:

"These groups are now available to you for consultation on any problems related to systems and procedures, as well as office practices generally.

"I hope each one of you will make use of this service when you wish to change or modify your management operations and so relieve you and some of your staff of this burden.

"I think I should make it clear that as with other advisors, the use of their services rests with you and any studies which they may make at your request will be followed by suggestions which have to be acceptable to you before implementation.

"They will also be available to assist you and your staff in putting into effect any such recommendations."

b. Establish and issue official company policies and standard operating procedures which will provide the necessary communication and operating channels to link the systems group with other elements of the organization.

4. *Directing the Conduct of the Systems and Procedures Assignments*

To "get the job done," a systems manager uses the procedures previously established for assigning work, controlling staff workload, and reporting progress. Two other special requirements are:

a. Allow staff sufficient time for *research.* In order to realize its full potential, the systems staff needs freedom of action to initiate studies of its own making, to elaborate on theories of operation, and to investigate alternative solutions to problems. Of necessity there must be a provision for a percentage of free time to be spent on theories of little immediate value, and perhaps of doubtful ultimate practical value, in order to evaluate all possible avenues of action.

b. Hold frequent staff meetings to maintain a high *esprit de corps* and to promote the interchange of information and ideas.

5. *Following-Up, Reporting, and Evaluating Progress*

The follow-up function of the systems department is so important to the success of the department's activities that it is hard to conceive of its being overlooked. Yet time and time again, this lack of effective follow-up results in a lack of complete effectiveness on the part of the systems department.

Follow-up on the completed projects of the department serves many valuable purposes. It enables the department to determine if its procedures and recommendations are being followed. If these changes are not functioning properly, the department may then determine why they are not being applied. Is it because the supervisor is lax in regulating the work of his group? Is it because insufficient instructions were issued in installing the system? Has the timing of the installation caused difficulties? Are there misinterpretations or misunderstandings of the system? Has a new situation developed which could not be foreseen?

The follow-up also enables the department to evaluate its work. Have the changes produced the anticipated results? Are operations proceedings as expected? How much has personnel been reduced? How greatly has the volume of work handled been increased?

Responsibility for the follow-up activity in the systems department should be independent of all other activities to insure that it is not subordinated to the seemingly more productive activities of the department and

to insure completeness and impartiality in the follow-up survey.[5]

6. *Minimizing Deterrents to Effective Systems and Procedures Work*

The systems manager and his staff should educate themselves to recognize and overcome "barriers" or deterrents to effective systems work in the organization. One of the most innocuous deterrents is *firefighting.*

Firefighting involves squelching emergencies and "hot" problems as they arise, ordinarily without careful planning or analysis. While it is rarely possible for a systems staff completely to avoid involvement in such activities, the following philosophy should be adopted wherever possible:

> ". . . Perhaps one should remind the reader that most companies rarely or never have or can afford a procedures staff large enough to handle everything in the organization capable of being described as a systems project. Therefore, the operating organization must be helped and encouraged to fight most of its own "brush fires" and must not be permitted to allow administration of established and accepted procedures to be a load upon the procedures department.[6]"

Conclusions and Observations

This article has tried to provide the reader with a comprehensive picture of complexities and challenges inherent in the process of organizing and managing a systems and procedures unit. The writer has made some related observations as follows:

Systems. Management is awakening to the realization that a business is essentially directed and controlled by decisions based on information supplied by its data processing systems and is realizing that much desirable information is not available within existing information networks. The development and maintenance of systems which supply a fast, complete, and orderly flow of information to management and upon which sound decisions and plans may be based, has become a major problem of administrative management today. Thus, management is faced with the challenge of improving information flows; making data more comprehensive, accurate, and timely; and reducing office costs. This is generally agreed to be a *systems* responsibility—and opportunity.

Authorities on automation assign the systems man a primary role in the development of EDP applications:

> "Probably more than 50 per cent of the automation job is procedure analysis . . . No new development in office equipment should be considered without first acquiring knowledge of the company's own systems, procedures, clerical costs, and report requirements. Furthermore, no large-scale equipment should be ordered before present methods are standardized and simplified . . .[7]"

Systems and Management Development. Systems and procedures experience provides an excellent medium for management development, since by the nature of systems work, an individual acquires a thorough grounding in three important qualities essential to dynamic, thinking management: analytical ability, creativity, and sales ability.

> "The systems department is regarded by most management-knowledgeable firms as an excellent training area for future executives, since its activities cut across functional and departmental lines and provide a top management view of company operations . . . therefore, many companies include a tour of duty with the (systems) department as part of their management training programs . . .[8]"

The Future of Systems and Procedures

A sort of renaissance is currently taking place in management's attitude toward the functions of planning and control. Increased recognition is being given to the systems and procedures function as a primary management planning activity.

5. Barish, pp. 272-274.

6. Costello, pp. 834-835.

7. Becker, pp. 45, 70.

8. John W. Haslett, quoted in Lazzaro, p. 22.

Controlling Service Parts and Accessories—in the Automobile Industry

The optimum result is to provide a given level of customer service with a minimum of inventory.

Howard W. Ambill and Dennis G. Price

The spare parts inventory problem in the automobile industry is no different in essence from that faced by other industries; namely, to provide a given level of customer service with a minimum of inventory. The magnitude of the problem, however, may be very different. Typically the automobile manufacturer carries upwards of 60,000 different parts in inventory ranging from gaskets at a few cents each, to complete engines costing hundreds of dollars each.

As in many other industries, service is extremely important. Non-availability of a vital part will result in loss of customer goodwill and if the bad service recurs, the customer may buy a different car next time he makes a purchase. Whenever a "back-order" occurs, therefore, every effort is made to alleviate it as quickly as possible. Moreover, since service is so important, parts may be serviced that have not been used in current models for twelve or more years. There is, in fact, no set policy as to when a part will no longer be serviced. If it still is selling at a reasonable rate, it will certainly continue to be serviced. Sometimes a part will even be

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A number of management authorities have predicted that the next decade will witness the replacement of middle-management personnel by specialists such as systems and procedures men who will compete with other specialists in operations research, data processing, and organization analysis. A challenge for the systems man at this time, therefore, lies in the need to clarify his role as a management planner, particularly in respect to his relationships with other "specialists." Is it possible that the term "systems and procedures" is no longer adequate to identify our field of specialization? **s/p/a**

serviced where the selling price is below the cost price. It is argued that the intangible benefits in good-will more than compensate for the financial loss.

To provide good service, it is essential to have an efficient national distribution system. Efficient control of 60,000 or more parts obviously needs the use of some electro-mechanical equipment, and, in fact, the typical automobile manufacturer uses a large-scale computer system to maintain up-to-date records on each part. Source documents to update records are sales cards, receipt cards, etc. This input information may be flown in from the various warehouses in the form of cards or as paper tape. The input is then converted to magnetic tape, which forms the input to the computer. Updating varies among the automobile manufacturers from three times to sixteen times per month.

Critical decisions of *when* and *how much* to buy for each warehouse may be made either by the computer or by an inventory control clerk. Usually, the computer has been programmed to make the decisions for slow-selling parts, but for fast-selling parts where orders are placed monthly with vendors, the clerk usually makes the decisions. To aid the clerks in this function, the computer prepares a status report showing for each warehouse some sales history, the inventory on hand, in transit from other warehouses, on order from the vendor, etc.

Chrysler Corporation decided to study the possibility of having a computer determine the quantity decisions on ordering and transferring the fastest selling parts between warehouses. The most important segment of the inventory accounted for about 3 per cent of the part numbers, but about 42 per cent of sales and 20 per cent of the inventory, valued at several million dollars at cost.

Preliminary Simulation

The Service Parts and Accessories Division of Chrysler Corporation has a large 700 series IBM computer and updates its inventory records three times per month. In order to determine a practical program for the selected segment of inventory, several months were spent in testing various sets of decision rules. The major functions simulated were as follows:

Sales Forecasting. This is a most important part of an inventory control system, so different methods were tested:

1. It quickly became apparent that any method relying on a previous year's pattern of rates was unreliable, since last year's pattern could be affected by factors other than seasonal and trend influences. For example, the subject part might have superseded another part, or its model application might have increased sales of the part and distorted the true sales pattern.
2. Various methods were tried which gave different weights to the prior three months' sales, weighing the most recent month the most heavily. It was found, however, that random factors were so important that a weighting method in many cases gave a poor forecast.
3. Some methods were tried which extrapolated previous trends. But it was found that if the previous period was long (six months), the forecast did not react quickly enough to big changes in trend, whereas if it was short (three months), the random factors previously mentioned could have a distorting effect.
4. The method finally chosen, therefore, combined use of an expected seasonal pattern and the prior three months' sales history (see below).

Computation of Safety Stock. Safety stock is the inventory to guard against fluctuations in sales and vendor deliveries. Many different levels of safety stock were tested.

Transfer Calculation. The central or base area warehouse was reviewed to determine if it had a surplus available for transferring to other outlying warehouses. If so, each outlying warehouse was reviewed to determine if it needed a transfer. The decision rules developed in the simulation are documented below.

Reorder Calculation. Each warehouse was reviewed to determine if an order should be placed with the vendor. Again, the decision rules pertaining to this are described below.

The results of the simulation indicated that a 25 per cent reduction in inventory could be effected with no increase in back-orders (i.e. the same level of service as was currently being attained).

Automatic Release System

Since the main output of the computer program consists of releases to vendors against existing purchase orders, it is called the Automatic Release Program. Other documents produced by the program are:

1. Inter-warehouse transfers.
2. Allocation cards. In many cases the vendor ships only to the base-area warehouse, where the Distribution Department in turn transfers the stock to the outlying warehouses. The amount to transfer is computed and printed on an allocation card.
3. Various types of punched cards.

The program is run three times each month: run 1, run 2, and the final run 3. The computer system is as follows:

Inputs. The master tape consists of a record for each part number, with such information as lead-time, vendor name and address, and the on-order status for each warehouse. Like all tapes used in the program, this one is in part number sequence.

The file maintenance tape contains receipt cards, transfer cards, etc., and is used to update the master record.

Outputs. The updated master tape reflects any new orders or transfers, etc., that have been placed. The release tape is used for printing releases to vendors. The allocation card tape is used to print allocation cards for the Distribution Department. The transfer tape is used for printing inter-warehouse transfers. The punched card tape is used to produce cards, which in turn update other records, or give certain information to the inventory control clerks.

Sales Forecast

The sales forecast is computed in the final run of each month, and is made for each month through the lead-time. There are three forces that create the observed levels of demand for a part:

1. *Long-Term Trend.* This may depend on how long the part has been out of production; that is, how long it has not been part of currently produced cars and trucks. If it is still in production, it may have an upward trend. If it has been out of production for some time, it may have a downward trend.
2. *Seasonal Influences.* Air-conditioning and heater parts are obvious examples.
3. *Random Factors.* Except for very seasonal parts, the random demand factors turn out to be by far the most important influence.

The national sales forecast considers these three demand forces by considering the prior three months' sales history and the expected seasonal pattern of sales. First, the three prior months' sales figures are changed into demand figures by adding the national back-orders for each month and subtracting the prior months' back-orders.

Next the demands of the three prior months are deseasonalized. Part of the input record contains two-digit seasonal factors which describe the expected pattern of sales for a year.

The simulations indicate that rarely do trends have an important effect in so short a period as three months. Therefore, the trend factor as well as the random factor is accounted for by averaging the prior three months' deseasonalized demands. This forms a base for forecasting. The forecast for each month of the lead-time is obtained by multiplying this base by the appropriate seasonal factor.

It is not always practical to rely on the previous three months' sales history and seasonal factors to compute sales forecasts. A mechanism has been provided, therefore, to allow a manual forecast to be used. This

transfers around the program subroutine thus computing the national sales forecast. A card is punched containing the manual forecast for each month of the lead-time, and becomes part of the file maintenance tape in the run 3 program. This method has been found useful in the following cases:

1. The model application for a part increases *substantially*. For example, a part is currently used on all Dodge models only. The application is then changed to include all Plymouth and Valiant models; a sudden jump in sales is to be expected. If one relies on the prior three months' sales history, the forecast would be too low, with a resulting danger of back-orders. A manual forecast is, therefore, input every month until the new sales level has been attained.

2. Part A supersedes part B, and Part B sales are *substantial* compared with part A. For the same reason as in No. 1 above, a manual forecast is input.

3. Occasionally, a sales promotion is conducted, where several parts are included in a package and sold to dealers at an attractive price. Again, sales may be expected to change suddenly, and a manual forecast is imperative.

The formula (Mwi) used to compute the sales forecast for any warehouse (w), for any month (i) in the lead-time is as follows:

$$Mwi = Mi \left[\sum_{j=-6}^{-1} Mwj \Big/ \sum_{w=1}^{6} \sum_{j=-6}^{-1} Mwj \right]$$

Subscript j is a month's sales of the prior six months for the warehouse.

When the national forecast (Mi) has been made for each month of the lead-time, it is then allocated to the warehouses. The simulation revealed that it was dangerous to allocate a national forecast based on the previous three months' sales of the warehouses. Random fluctuations were too important. Therefore, six months' sales history is used and this increased spread minimized the effect of random fluctuations in the allocation.

Safety Level

The safety level for each warehouse (Sw) for each part is also computed in the final run each month and is basically a function of the sales forecast. A safety stock is necessary to guard against upward fluctuations in sales and delays in delivery from the supplier. The *Sw* is the stock level that one expects on the average to have on hand when a delivery is received.

The safety level naturally varies with the forecast unit sales. A warehouse selling 40 pieces per month needs a *relatively* higher safety level than one selling 400 pieces per month, since the *relative* fluctuations are greater. The decision rules pertaining to safety level have been formulated empirically to meet a given standard of customer service (defined as a given level of back-orders).

This "base" safety level is then modified by several factors:

1. If the part is a competitive part (competes with parts distributed by other manufacturers) so that a back-order could mean a lost sale, the safety level is raised somewhat.

2. The ease or difficulty of expediting delivery from suppliers is important. If the short delivery quantity can be increased with short notice (a shelf item), the safety level is lowered, since a potential back-order situation can be remedied quickly. If it is difficult to change the delivery quantity, then the safety level is raised at the base-area warehouse, in order to have some availability for emergency transfers.

3. Two parts may have the same mean expected sales for a month, but the

deviation around this may be very dissimilar. A variability factor, part of the input record, considers this. Parts with large random sales fluctuations have a higher variability factor (and hence higher safety level) than parts with small random sales fluctuations.

4. Some parts have to be processed by the receiving warehouse (put in packages) and are not, therefore, immediately available for sale. If this processing takes, say, one week, then a week's sales must be added to the safety level.

The safety level, therefore, reflects many factors, and the protection afforded varies from part to part and with each warehouse for each part.

Transfer Calculation

In each of the three runs, a review is conducted to determine whether the base area warehouse (from which transfers are made) has any stock available to transfer. If so, the outlying warehouses are reviewed to determine if a transfer is needed. This review is made to counter a potential back-order situation, and to obviate placing an order with the vendor.

The computation is always carried out through Month 1. (Run 3 is considered to be the beginning of Month 0). The base area transfer availability (TA_B) (in run 3) through Month 1 is defined as:

$TA_B = OH_B - (S_B + M_{BO} + M_{B1})$

where OH_B = On hand inventory at the base area

S_B = Safety level at the base area

M_{BO}, M_{B1} = Sales forecasts for this and next month at the base area

This factor does not often turn out to be positive, since this would mean that the base area is overstocked. But this condition may occur, if the initial buy, when the part was set up (and before it came under the system) was too large, or if a vendor overships to base area.

If a positive balance exists, each outlying warehouse is reviewed to determine if it needs a transfer through Month 1:

The outlying warehouse availability (A_w) is defined as:

$A_w = OH_w + IT_w + OO_{wo} - BO_w$, where

OH_w = On hand inventory

IT_w = In-transit transfers between warehouses

OO_w = On-order deliveries due from vendor

BO_w = Current back-orders

The warehouse requirements (R_w) are defined as:

$R_w = S_w + M_{wo} + M_{w1}$

Where: S_w = Safety level

M_{wo}, M_{w1} = Sales forecasts

If $R_w > A_w$ by more than $1/3\ M_{wo}$ (to eliminate the transfer of insignificant quantities), the difference ($R_w - A_w$) is rounded in transfer multiples and printed on a transfer form. If the difference exceeds what the base area has to transfer, then only what is available is transferred.

The transfer calculation is also made in runs 1 and 2, with suitable modifications in TA_B, A_W, and R_W, to reflect the fact that requirements through Month No. 1 are one-third and two-thirds of a month's stock less, and that A_W now includes the order if any for Month No. 1. In addition, one-third of a month's forecast sales are deducted from R_W, so that if a transfer is *still* necessary, sales must have increased far above expectation.

Run 1:

$$\begin{aligned} TA_B &= OH_B - [S_B + 2/3\ M_{BO} + M_{B1}] \\ A_W &= OH_W + IT_W + OO_W - BO_W \\ R_W &= S_W + 2/3M_{wo} + M_{w1} - 1/3\ M_{wo} \\ &= S_w + 1/3M_{wo} + M_{w1} \end{aligned}$$

Run 2:

$$\begin{aligned} TA_B &= OH_B - [S_B + 1/3M_{BO} + M_{B1}] \\ A_w &= OH_w + IT_w + OO_w - BO_w \\ R_w &= S_w + 1/3M_{wo} + M_{w1} - 1/3M_{wo} \\ &= S_w + M_{w1} \end{aligned}$$

As in run 3, transfers are only made if $R_w > A_w$ by more than $1/3\ M_{wo}$.

Allocation of Next Month's Order Quantity

In the final run each month, a release is written which instructs the vendor how much to deliver to each warehouse the following month, and also how much is required nationally for each remaining month of the lead-time. The allocation of next month's

order may vary somewhat from what has previously been ordered for that month. For example, in July, we may tell the vendor that delivery requirements are 1,000 pieces for September, but in August we may find that this must be changed, if possible, to 1,200 pieces. Decision rules have been established to keep changes to a minimum.

Each warehouse is reviewed and its availability (A_w) and requirement (R_w) through Month 1 are calculated.

$$A_w = OH_w + IT_w + OO_w - BO_w$$
$$R_w = S_w + M_{wo} + M_{w1}$$

If $R_w > A_w$ by more than $1/3\ M_{wo}$, (to eliminate ordering insignificant quantities), the difference ($R_w - A_w$) is rounded in order multiples.

The sum of the amounts above forms the basis for the total order placed with the vendor for delivery in Month 1, which is a month from the date the release is written. If the total amount required is less than that previously ordered from the vendor for Month No. 1, but the surplus on order is less than one-third of a month's national sales ($1/3\ M_1$), then the surplus is allocated to those warehouses that require an order for Month 1. If the surplus is significant ($> 1/3$ M), it is rescheduled to Month 2. This is done except for part numbers with a code indicating that it is difficult to change the order quantities on short notice (castings, etc.). For these cases, the surplus in Month 1 is allocated to those warehouses that require an order for Month 1.

If any warehouse is calculated to require part or all of its delivery sooner than Month 1, to prevent possible back-orders, an asterisk is printed against the quantity on the release.

The quantity computed for each warehouse for Month 1 is shown on one line of the release, if the vendor ships to each warehouse. If he ships only to the base area, only the total figure is shown on the release. This total is allocated by the Distribution Department to the various warehouses, based on an allocation card which is produced by the computer.

It is possible to add to the order quantities for delivery in Month 1, during run 1 or run 2, if sales have increased far above expectations. Of course, R_w changes to reflect the fact that requirements through Month No. 1 are less by one-third and two-thirds of a month's stock. In addition, one-third of a month's forecast sales are deducted from R_w, so that if an increase in the order quantity is *still* necessary, sales must have increased substantially:

Run 1:

$$A_w = OH_w + IT_w + OO_w - BO_w$$
$$R_w = S_w + 2/3M_{wo} + M_{w1} - 1/3M_{wo}$$
$$= S_w + 1/3M_{wo} + M_{w1}$$

Run 2:

$$A_w = OH_w + IT_w + OO_w - BO_w$$
$$R_w = S_w + 1/3M_{wo} + M_{w1} - 1/3M_{wo}$$
$$= S_w + M_{w1}$$

As in run 3, the order is only increased if $R_w > A_w$ by more than $1/3M_{wo}$.

Review of Order Quantities After Month 1

In run 3 only, a review of the order quantity for each month through the lead-time is made, and the order quantities adjusted, if necessary. For example, in determining the order quantity for Month No. 2, a comparison is made of requirements with availability through Month No. 2. If the calculated national order quantity varies from what was previously ordered for Month No. 2 by less than one-third of a month's national sales ($1/3M_2$), then the order quantity is not changed. This is to minimize vendor rescheduling.

When the quantities for each month through the lead-time have been computed, the program calculates the increase (if any) in the order.

Results Obtained

The implementation of the system summarized above has been spread out over several months. Every month more part numbers are put on the system. Results obtained so far indicate a drop in inventory of approximately 20 per cent with no significant change in back-orders. Some increase in follow-up activity has occurred, because when working with smaller inventory, it is important not to allow the vendor to delay his deliveries. However, this has been offset by eliminating work involved with forecasting, ordering, transferring, and preparing associated forms. **s/p/a**

Photographic Data Processing Suggestions for the Systems Man

The Marvelous Possibilities of Electronics and Photography to Record Non-Accountable Information

John Waddell

● Photographic data processing can be considered from two standpoints: (1) What you can do now with available equipment, and (2) what you may be able to do in the future.

Reviewing the first aspect, in many companies, there are two kinds of information which the systems man is concerned with processing:

1. **Accountable Information** — such as bank accounts, accounts receivable, and inventories. With such subject matter, you are generally concerned with adding or subtracting quantities and the information you want from the system is a quantity. Most data processing equipment for business seems to be concerned with this type of information.
2. **Non-Accountable Information**—such as engineering drawings, medical records, insurance files, and things like deeds to land.

We have a relatively small amount of accountable information in our business compared to the vast amount of non-accountable data. For instance, if you buy a house tomorrow and record the deed with the Cook County Recorder, it will be assigned a document number around 17 million. That number means there have been 17 million deeds, mortgages, etc., assigned since the current series of numbers began in the late 1800's. We need a record of every one of these. We do not expect to re-examine more than 20 per cent of those already on file; but with the exception of items like released mortgages,

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we can't tell which ones of this vast store of information we will need.

Recording of Deeds

Deeds are only one of our information storage problems. First, the photo data processing method we are using now for deeds will be described. Our systems group got the assignment to develop a photo take-off of deeds in July, 1954. At that time, a staff of abstract typists examined every deed and made a six-part typed abstract of each of them. A typical deed is a form with several hundred printed words. The typist was trained to recognize each of the dozen or so standard forms and if the people who filled it out (for example, the lawyer for the seller) had not altered the stock language, the abstractor-typist could boil all this down into two key strokes (e.g., a warranty deed becomes WD). Then she copied the variable data like the name of the grantor and the legal description verbatim. Here, of course, was the big risk of error, i.e., in the legal description. If lot 5 were typed as lot 6, the abstract described the house next door; if block 5 were typed as 6, it was across the street and if township 41 got shown as 31, you might well be in another suburb. Naturally we had all sorts of double checks to catch these errors because today's $1,000 lot may be the key parcel to a $1,000,000 industrial site a few years later.

These documents are filed by the public at a current rate of 400,000 per year, 2,200 on a big day. We need to get a complete accurate record of every one of them within hours of the time they are filed. This required close cooperation with the County Recorder who is terribly crowded for work space and part of this cooperation meant reducing our staff of people who consult the public records. It also meant that we could not install any large complex machines in the Recorder's office.

We considered closed circuit T.V., facsimile transmission, contact printing devices, and conventional photostat machines, which at that time had a speed of about one document a minute, were about 17 feet long, and required hot and cold running water.

We read articles about high speed smoke printing and how the Army handled V-Mail. We talked with systems people who had more engineering drawings than we had deeds. And out of all this plethora of information and advice we decided on a 35 mm microfilm planetary camera as our basic photographic device.

We had been taking snapshots of animals in the zoo, family parties, and vacation scenery for years. We had taken many movies and had made enlargements. Consequently, taking a picture of a little piece of paper lying still under controlled light seemed to present no problem. The fact is, actual photography of documents probably has just as many bugs to eliminate as any electronic or mechanized system. Stories of double punching on tab cards or dust on computer tapes can be matched with ones about water temperature in the developing solutions or fluctuations in line voltage affecting the lighting. But difficulties like these do not mean any more or less than they do in other systems. They can be overcome, especially if you are fortunate enough to have a resourceful man on your systems staff who can invent a solution to the problem if the equipment manufacturers have not thought of it.

Photo Abstractions

We installed our first microfilm cameras in 1955 for photo take-off. We do what we call "photo abstracting" with them. That is, the camera operator reads the document just as the abstract typist did with two objectives in mind. One is to minimize the number of pictures, e.g., we do not photograph pages 2, 3, & 4 of a stock mortgage. Every deed has two sides and if we did not photo abstract, we would at the very least have twice as many images (and paper enlargements) even if there were nothing on the other side but the statutory notary acknowledgement.

Our other objective is to have the camera operator note obvious defects or special clauses which would not appear in a single photo. A simple example of a defect—the notary failed to affix his seal. To handle these, the operator has a supply of "overlay

slips" with language typed on them to cover the case, e.g., "Notary Seal missing". The rule for the operator is simple—if you don't know, take a picture. But our experienced operators keep the ratio of 125 pictures to every 100 documents compared to about 350 pictures per 100 documents if every side of every page was photographed.

We cut the film from the cameras every hour and process it in our own darkroom. These are short strips of film—maybe 8 or 10 feet of images plus 3 feet of safety wrap on each end. We do this developing by hand. We slide the film into a Nikor reel in the dark; dunk it in a series of solutions for clock-timed intervals; and air dry it on a wooden reel. We have an automatic processor which does a fine job on a full reel of film but it is like using a steam shovel to dig a post hole to mix solutions and maintain water temperature to use the processor for short strip film development.

After this first stage of installation of film, we still had all those abstract typists so instead of going immediately to our final objective, we provided them with film readers and produced the same typed abstracts as before. The effect of this was simply to reduce the number of people in the county office. They now worked in our office. As soon as we were able to place these people and had worked out other details, we went on to the next step.

The next step was installation of two photostat continuous processors. Each image was positioned in front of the lens, the operator pushed a button and produced a paper enlargement. We needed six copies of each. A peak load was 2,200 documents in a day. This required a capacity of 2,750 images times 6 or 16,500 enlargements in a peak day.

It seemed we would need 4 machines and more than 4 operators to handle a capacity day until we developed the technique of shooting two documents simultaneously on the camera so we had what amounted to one image of two documents with a predetermined space between them. Then, by getting special lens and paper feed in the processors, we simply doubled the capacity of the processors.

We started with a 60 per cent reduction from original size because the 60 per cent enlargement was the same size as the typed paper abstracts and because "scientific studies" (and that phrase is in quotes) made by library scientists had shown this was the optimum reduction of newsprint tolerable for reading. We found the whole organization—everybody that used our photo enlargements—complained about the size. They said they couldn't read the photographs and frequently we were confronted with a photo sample of a poorly prepared document, the original of which would have been hard to read. We had to agree we could not read it either.

So—we altered the lens system and paper feed again and produced a 70 per cent enlargement. This we find meets legibility requirements.

We found the operator making enlargements got bored counting to six and of course there were special cases where only 1 to 5 copies were needed. So if, by mistake, only 4 or 5 were made instead of 6, there was endless trouble about routing copies and correcting the failure by finding the image again after the error was discovered. To solve this, we designed a black box and held hands with photostat engineers until they came up with a cycle counting control where the operators can get any selected number of copies by turning a knob and pressing a button.

Today, with new equipment, we process our strip of microfilm in the form of a continuous loop and run it through six times. We photograph a spot to trip the photoelectric cutter and when everything is going good we get a stack of copies in numerical sequence about as fast as we can pick them up, thus avoiding even the work of separating copies into sets.

We splice our short film together for storage in reels and use the paper enlargements for posting our tract indexes and for examination of titles. As you may imagine, title examination frequently involves the old typed abstracts as well as the photo copies. But I suppose the day will come when our people won't even recognize an abstract.

One of the reasons for mentioning this as a story of a methods change is to illustrate

just how rapidly progress has occurred and the rate of change seems to be accelerating.

New Photographic Developments

There has been a bewildering number of new photographic devices and techniques in the last 5 years. For example, film and lens improvements make reductions of 60 to 1 practical for microfilm. You can put six images of six lettersize papers on a bit of film 16 mm square. That's half the size of a postage stamp.

We have considered a wide variety of developments in this field during the last 5 years. A few will be mentioned not because they are so new, but in the hope they may interest you as systems men who may want to follow up on one of them.

Until 3M introduced its microfilm reader-printer in 1958, it was not easy to secure paper enlargements from film and many people still think of film as something you look at on a viewer.

The Documat is a new microfilm viewer-printer. This is being marketed by Bruning and Watland. It produces cut sheets prints on the same kind of paper you get in contact photo copiers. It operates like the 3M printer, which as you know gives prints on coated aluminum foil. This machine produces letter-size prints for about 8c material cost. There are some advantages to paper as compared to the 3M prints. A variety of lens choices is offered so that if you have films made at various reduction ratios, it is reasonably easy to change lenses.

Film Copies

Another idea, which may help some systems man, is Diazo film. Suppose you have a file of regular negative microfilm which will give you black on white prints and you want to copy the whole film file to set up another file of film. You send a reel of film off for a copy and get back a positive film. This is hard to look at on a viewer and if you make paper prints from it you get white on black. The solution is a Diazo film copy. The image is no longer a silver base chemical but a dye. A Diazo film copy is the same as the original, for practical purposes.

Although it is second generation film, it's better than a copy of a copy which must be made to get a conventional silver emulsion like your original negative. It is also less damaged by scratches when used often.

Photostatic copies are so well established the word is part of the language. But perhaps you have accepted any photo copy as a photostat without considering archival quality. If you are basing any system on the idea that your photo copies will be legible several years from now, it is necessary to go into this. Otherwise, the young systems man of today may be ready to accept a well-deserved promotion about the day that someone discovers the vital information has faded right out of the files. Photostat itself offers machines that will make short life paper copies as well as the elaborate machines that work permanent prints.

Archival quality applies to microfilm too. If you are having the film developed by some quick cheap process, the images you get may equal anybody's film. But if you plan to use this film for years after it's made, give consideration to the permanence of these images.

Rapid Access to Images on Film

There is and always has been a serious limitation on rapid access to film when stored on reels. The first viewers had hand cranks, then they motorized the cranks and the latest in this evolution of finding film on reels is the magazine used in Recordak's Lodestar. This device, which has been available for a year or two, presumes the film has been pre-indexed for a visual rough-sort. In other words, you snap in the magazines, press the button until the screen shows you are close to the place on the reel you want and then find the specific image by looking at each one.

A firm called F.M.A., Inc., in El Segundo, California has a system by which an index code is printed photographically next to the image. Their film reels are then scanned to pick the desired images and print them. This may work if you have a complex information retrieval problem and about $100,000 for a system.

Another way to get at the image more effectively than by going through a whole

reel is to cut the film in strips, file it in jackets like card files. We have done a lot of this. The job of putting the film in jackets and indexing them represents costly handwork and once the film is in the jackets, you are committed to a jacket system. For instance, you can't then decide to duplicate the film.

Aperture cards,—punched cards with aperture holding short strips of film—have been used for years. Argma, the Army Missile Agency, has put 7 million documents into aperture cards since 1957. The Department of Defense now requires their prime contractors to submit engineering drawings directly on microfilm in aperture cards. This makes a lot of sense. It reminds me that when the brokerage houses in New York began to hand each other punch cards to settle up daily transactions between them back in 1948, it appeared that their tab machines were talking to each other.

As an example of a round-about way to find out about things in the photo data field, take the case of Actifilm, which is roughly an aperture card that's all aperture—no card. Datagraphic Systems in Santa Monica, California have a special film copier that puts images on a piece of stiff Diazo film from regular microfilm as input. It seems we could put 16 deed images on a tab card shaped film. This is only for manual filing but may have an application in interfiling with aperture cards.

Future Developments

Now, as to the future. In June, 1960, the Senate of the United States directed that a report titled "Documentation Indexing and Retrieval of Scientific Information" be printed as Senate Document 113 now for sale by the Superintendent of Documents in Washington for 70 cents. It contains details of photographic devices we had demonstrated behind closed doors less than a year before. In September, FORTUNE magazine's cover turned out to be an enlargement of the coding on a Recordak minicard film chip. An article in that issue on Information Retrieval summarized most of the new developments in the field of Photographic Data Processing.

Kodak's Minicard and Itek Corporation's Itekard are interesting examples of what we may see developing, just as computers have become smaller and less costly.

The film chip is a unit record, with capacity for storage of both graphic and digital information. It has high data storage capacity. For instance, all the words, formulas and diagrams on a 12-page research report could be recorded on a single chip.

Chips can be handled something like punch cards on special equipment. They can be sorted, inter-filed, searched, and duplicated. The digital information in minicard is in optical spots. In Itek's system, the indexing and search is electronic. This digital coding is compatible with electronic computers so that the look-up or the subject type index can be manipulated in a computer either to save time in searching the file or to create a variety of search techniques.

Since chips are unit records, the file can be purged of outdated information. Finally, the end product of a search is directly usable. If the problem is to find a deed, or a hospital record, or an insurance claim file and give it to someone to examine, the print-out can be a photographic enlargement.

For a quick summary of minicard, read FORTUNE's article in the September, 1960 issue. You can find out something about Itek and what IBM is doing in photographic data processing from the Senate publication mentioned.

Incidentally, IBM still seems to be keeping its Walnut Project under wraps, although they mentioned it in their report to stockholders over a year ago. Their Advanced Systems Development Division has been working on photographic data storage and their research is going into something called photoscopic memory.

Avco/Crosley's Verac can pack 10,000 images of legal size documents on a sheet of film 12 inches square. That is about 75 per square inch. The developed film looks like a high aerial photograph of a parking lot—10,000 tiny little black rectangles all arranged in rows like neatly parked cars. Of course, the equipment to make these photographs has to be extra-ordinarily precise and the

equipment to locate and project the image desired is likewise much more precise than anyone who has used conventional microfilm viewers would expect.

This Avco product is an information retrieval system. A precise step and repeat camera makes the image on the sheet of film with a high resolution lens. These images are precisely spaced in rows so that the address of an image can be, for example, row 17, column 96. The recording rate of the camera is reported as one image per second.

To use these sheets of film produced by the step camera, they are mounted as a group of 99 matrix planes in a machine. The address of an image in the group is now a 6-digit number, e.g., row 17, column 96, film plane 41. The machine given this address selects film 41, pulls it up to put row 17 in front of a lens and moves the lens to position 96.

This means they have random access to any one graphic image out of 1,000,000 in one second. Now, like a computer, there is no point in such speed if the object is to find just one image and hold it on a screen. Consequently, they gear it to an electronic search for the address of a lot of images and the document output is either conventional microfilm or high-speed electrostatic paper print.

Conclusion

All this future development may catch up with us, and the unbelievable of today may be real tomorrow. Let me conclude with a story from Itek. They wanted to test the effect of filters on photographic film and for technical reasons built a special camera with a telescopic lens about 20 feet long. They took this to the top of Pikes Peak and shot pictures of the tall buildings in Denver some 70 miles away. You could count the panes in the windows of these buildings. **s/p/a**

BOOK REVIEWS

Systems & Procedures

Anthony Ross

Electronic Data Processing and Auditing, *by Dr. Felix Kaufman, C.P.A.; Roland Press Company, New York, 180 pp., 1961, $6.00.*

The author, Dr. Felix Kaufman, is eminently qualified to discuss both EDP and accounting. Dr. Kaufman's experience goes back to the early days of EDP with work as a systems analyst for the initial electronic computer project at RCA. He has C.P.A. certificates from both New York and Pennsylvania.

Dr. Kaufman's comprehensive treatment of the effects of Electronic Data Processing on accounting and auditing practices is addressed to all who are concerned with the control of EDP systems. The book begins by describing the elements of an EDP system, describes the way they are planned, and analyzes EDP requirements for typical basic accounting applications. The reliability of such systems, the necessary internal control systems, and the auditing requirements are discussed. Internal controls and audit trials are fully discussed. Particular emphasis is placed upon the inseparability of internal control procedures from electronic data processing processes.

In summary, Dr. Kaufman does a good job of describing the use of EDP to auditors and accountants in a setting orientated to their interests. For systems men who design EDP systems, material is presented which should lead to a better understanding of the needs of less sophisticated interests that nevertheless have a genuine concern about control. *(Reviewed by Michael Miskulin, Pres., National Computer Analysts of New York; Lincoln Square Chapter, SPA.)*

Executive Control—the Catalyst, *by William Travers Jerome III; John Wiley & Sons, Inc., New York, 275 pp., 1961, $6.95.*

Dr. Jerome begins his book by affirming the need for long-range planning in large-scale business. He ends with three chapters describing highly organized, formal plans: DuPont, General Electric, and Koppers Company. His significant contribution is an analysis of the implications of long-range planning for business, particularly in changing the nature of the financial function in internal controls, in budgeting, and in reporting to line management.

Criticisms of traditional finance techniques are:

1. The budget or one-year plan, in the absence of longer-range plans, becomes an absolute, with managers forced to live within it regardless of circumstances.
2. The use of absolute numbers to compare actual with budget figures divorces the current year from its relationship to long-term objectives and past trends.
3. The rule of checks and balances puts a transaction in the hands of more than one person, creating communication and coordination problems thereby, without solving the problem of $1 billion of annual losses due to fraud.
4. The span of control refers to the supervision of subordinates with interlocking activities and responsibilities.

These techniques have been outmoded by long-range planning, the use of ratios in place of absolutes, and the use of profit centers.

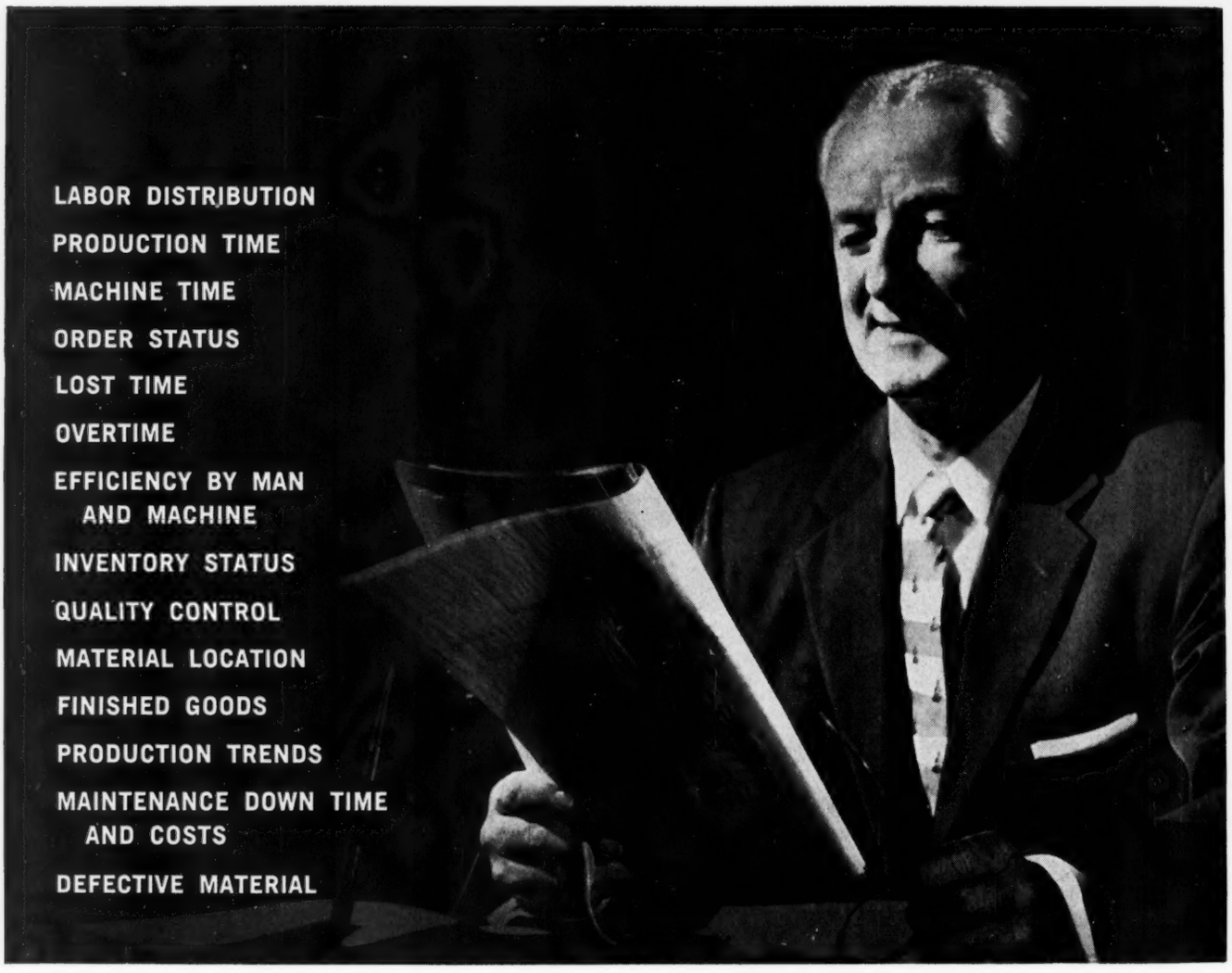
The author implies that consultative or democratic managers of divisions and smaller profit centers are more likely to be successful. Although research of the survey research center clearly demonstrates the value of this approach for the first-line supervisor, the same has not been demonstrated for profit-center managers. Indeed, it seems quite possible for managers with unusual foresight to succeed in achieving a high return on investment in the long and short run, using autocratic methods. *(Reviewed by William A. Frank, American Thread Company; Lincoln Square Chapter, SPA.)*

Progress In Operations Research (Volume I), *Edited by Russell L. Ackoff; John Wiley & Sons, Inc., New York, 505 pp., 1961, $10.00.*

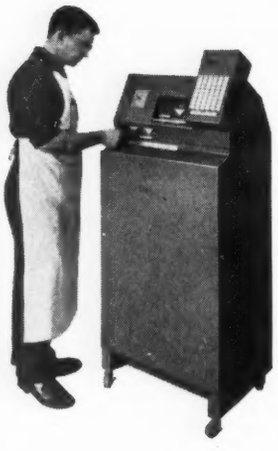
This volume is a compilation of articles by different authors. Topics are: Decision and Value Theory; Dynamic Programming; Sequencing Theory; The Meaning, Scope, and Methods of Operations Research; A Survey of Inventory Theory from the Operations Research Viewpoint; Mathematical Programming; Dynamics of Operations Systems; Replacement Theory; The Theory and Application of Simulation in Operations Research; Military Gaming; and Progress in Operations Research.

This is the first book in a series designed to review the entire operations research field, and is written mainly for OR practitioners. The primary concentration is on technical progress. A survey is made of practical applications, methodoligies, and problems.

The need to bring such writings to the pragmatic level of most executives and systems people has not been entirely resolved by this volume. Nor has the problem of linking together diverse writings of many contributing authors been entirely overcome. In addition, the case examples are oversimplified and take many points for granted. *(Reviewed by Edward A. Tomeski, Socony Mobil Oil Company, Inc., Lincoln Square Chapter, SPA.)* **s/p/a**



How many of these facts are you NOT getting?



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EDITORIAL

THE ART OF COMMUNICATING

● A systems man cannot function effectively unless others understand what he is trying to accomplish. Take for example, the writing of procedures and reports. Do others understand what you write? Do you write so that they can understand with a minimum of effort? Are you critically reading your written words and striking out all excess verbiage? Are you cultivating the habit of using active rather than passive verbs? Are you studying the writing habits of masters of the art?

Systems men must be able to communicate clearly. A systems man's recommendations should be presented forcibly and clearly. Too often management buries the recommendations of the system man in a good-intentions file. Yet, this is not always the fault of management. Many systems recommendation reports are phrased in a language comprehensible only to another systems man. Top management cannot clearly see the benefits of a recommended procedural change because they are not clearly presented.

The same clarity and persuasion that is applied in recommendations to management should also be used in introducing approved methods and procedures to line supervision and employees. Systems are at best a way of getting people to function more fully, of helping them to realize their potential as human beings and as members of a business organization.

But how does one go about the art of communicating clearly and persuasively? It is in fact an *art* and not a science. It is an art as demonstrated and practiced by Sir Winston Churchill, the master practitioner. To him "good English" meant accuracy, brevity, and the right emotional tone.

Sentences should vary in structure and length but, for easy reading and comprehension, should be short. If there is a simple way of saying a thing, say it that way. This does not mean that you must limit your vocabulary. Intelligence and vocabulary are linked but long words do not necessarily indicate high intelligence. The ability to use the *right* word at the right time is more likely to reflect intelligence.

Nothing weakens written thoughts so much as extra words. Avoid unneeded words; make every word carry its weight.

Put action into your verbs. Don't overwork passive verbs. Prose can usually be kept impersonal and still remain in the active tenses. Use terms your reader and listener can picture. Abstract terms make a discourse dull and foggy. Tie in with the experience of your reader or listener. He will get your new idea or procedure if you link it with some old idea he already has. Come to the point immediately. In a report, a procedure, or a recommendation, state your conclusions or recommendations first. Unfold the details later so the reader can examine the facts upon which the conclusions were based, or the practitioner can study the details of operation with a general concept in mind.

No miracle solutions, magic potions, or mysterious techniques will help the systems man to communicate more clearly. Improvement comes only as a result of conscientious effort and practice. The importance of conscientious practice cannot be overemphasized. The systems man must study and practice good writing principles at every opportunity. **s/p/a**

(William J. Boesch, member, Motor City Chapter, SPA and chairman International SPA Publications Committee).

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